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ABSTRACT

Designed as a part of a multidisciplinary set of curricula and educational materials on the Columbia River, this teacher's guide focuses on the many uses of the river and the conflicts arising from those uses. This unit's major purpose is to help students in grades 5-8 to start thinking about how the resources of the Columbia River should be managed. Each unit addresses a specific subject area and contains a reading and group of activities. The subject areas include: (1) history (highlighting Indian legends); (2) energy (concentrating on hydropower); (3) fisheries (including career options); (4) agriculture (including recipes that use food grown in the Columbia River area); (5) recreation (examining water supply, conditions, and management); and (6) navigation (focusing on river vessels and the shipping trade). Extended activities are also included for the enrichment of interested students. A summary section contains an overview of the unit and review activities. An annotated list of publications and audio-visual materials that relate to the Columbia River is also included. (ML)

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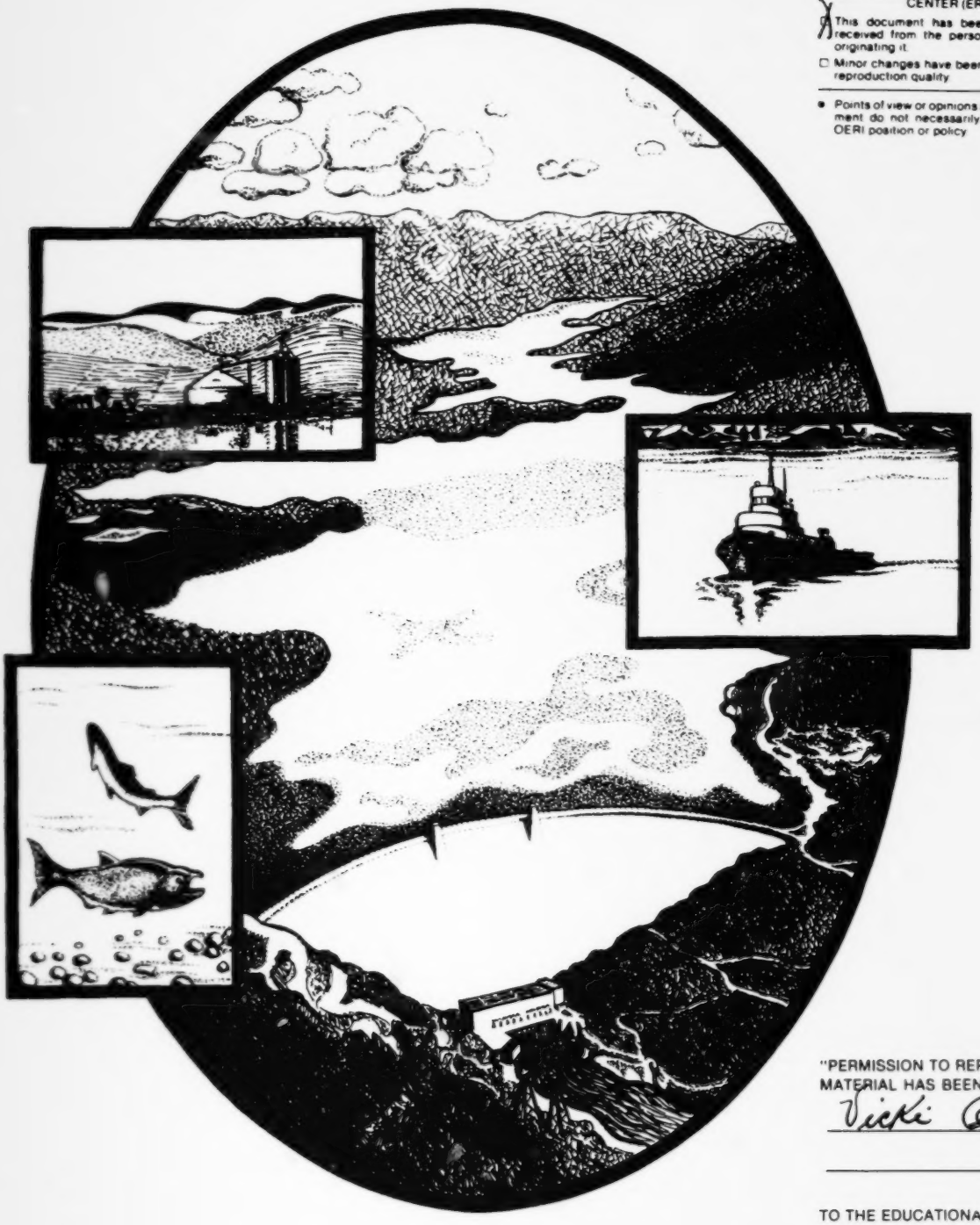

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The Columbia River: Its Future and You

Teacher's Manual for Grades 5-8

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The Columbia River: Its Future and You

Grades 5-8

Oregon State University
Sea Grant College Program
AdS A402
Corvallis, Oregon 97331

Publication No.: ORESU-E-85-001

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The project is funded by the Oregon State University Sea Grant College Program and the Washington Sea Grant Program, under the direction of Vicki Osis, OSU Marine Education Specialist, and Mike Spranger, WSU Marine Resources Specialist, Columbia River System.

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A Note to Teachers

The Columbia River system is a complex topic to study. There are many, many activities a teacher could do with a class to present the major concepts in such a study.

The activities described in this booklet cover the basics of the Columbia River system. Completing these activities with your class will take about six weeks of your social studies/science periods. Extended activities are included for use as enrichment with interested students.

The activities are arranged by subject: general information, hydropower, fisheries, agriculture, recreation, and transportation and navigation. The summary at the end provides an overview.

You may want to alter the activities to better suit your style of teaching or your particular class. Such adaptation should make these activities even more effective in teaching the overall point of water budgeting.

In all your class discussions, try to stress the need to make responsible decisions on the proper use and management of the water resources of the Columbia. There are no absolute right answers to the question of "Who should get how much water?" The purpose of this educational project is to increase student understanding of the many uses of the Columbia River and to start students thinking about how the resources of the Columbia should be managed.

Teaching Resources

Teachers are encouraged to send for the following materials for background information and use in class. Most of the items proved useful in preparing this curriculum.

Literature

Publications preceded by an asterisk are more technical than the others.

- *Are We Prepared for the Next Drought? May 6, 1983. Conference proceedings. WSG-WO-83-2. Obtain from Washington Sea Grant, 3716 Brooklyn Avenue N.E., Seattle, WA 98105-6795. ($9.00)

  Discusses the impact and implications that a serious low-water year (drought) would have on the Columbia River system and the Pacific Northwest. Papers are from major users and water managers of the Columbia River system. (135 pp.)

- The Columbia River: A Time of Decision and a Question of Balance, by Mike Spranger. October 1982. WSG-AS-82-2. Obtain from Washington Sea Grant, 1919 N.E. 78th Street, Vancouver, WA 98665. (Free)

  This advisory report gives a broad overview of the multiple uses of the Columbia River and discusses emerging conflicts and trade-offs.

- The Columbia River Gorge: A Unique American Treasure, by Mike Spranger. EB 1193. Obtain from Ag Bulletin Room, Washington State University, Pullman, WA 99164-5912. ($5.25/bulk discount available)

  Provides an overview of the history, geology, ecology, and development of the Columbia River Gorge. It contains detailed maps, historical photographs, and extensive bibliography. (76 pp.)

- The Columbia River Gorge Coloring Book, by Charles Martin. Available from Eagle Sign, P.O. Box 21, Hood River, OR 97031.

  Shows wildlife and historic events that occurred on the river.

- Columbia River Projects, a pamphlet on Bonneville, The Dalles, and John Day dams. Obtain from Portland District U.S. Army Corps of Engineers, 319 S.W. Pine, Portland, OR 97204. (Free)

  Describes the operations, management, and multiple purposes of these major Columbia River dams.

- Columbia River Salmon, A Resource in Danger, by Mike Spranger. 1983. Obtain from Washington Sea Grant, 1919 N.E. 78th Street, Vancouver, WA 98665. ($1.00)

  Describes the rich history and life cycle of the Columbia River salmon and discusses the many reasons which led to the decline of this resource. Also outlines several ongoing efforts to preserve and enhance fish resources within the basin.

- *The Columbia-Snake: Challenges for Multiple-Use River Management. 1981. PNW Bulletin 212. Obtain from Mailing Services, Oregon State University, Corvallis, OR 97331. (25¢)

  A 15-page publication describing the many uses, conflicts, and trade-offs of the Columbia River system.

- *Control and Management of the Columbia-Snake River System, by Philip R. Wandschneider. 1984. XB 0937. Obtain from Bulletin Office, Washington State University, Pullman, WA 99164-5912. (Free)

  Reviews the institutional agencies and decision-making processes that are involved in managing the Columbia River system.

- *Energy Trade-offs and Economic Feasibility of Irrigation Development in the Pacific Northwest, by Norman Whittlesey, et al. 1981. Ag Research Bulletin 0896. Obtain from Ag Publications, Washington State University, Pullman, WA 99164-5912. (Free)

  Describes irrigation development in eastern Washington and trade-off issues between energy and water.

- *Magnificent Gateway, by John Allen. Obtain from Timber Press, P.O. Box 1632, Beaverton, OR 97075. ($8.50)

  A book describing the geology of the Columbia River and Columbia River gorge. It also contains a mileage road log, excellent for self-instructed field trips on the geology of the gorge.

- *The Making of Oregon: A Study in Historical Geography, by Samuel N. Dicken and Emily F. Dicken. Obtain from the Oregon Historical Society, 1230 S.W. Park, Portland, OR 97205.

  This book discusses the natural history of Oregon.

- *Navigation and Commerce on the Mid-Columbia/Lower Snake River System, by William McNamee and Lewis Queirolo. 1981. PNW #213. Obtain from Ag Publications, Washington State University, Pullman, WA 99164-5912. (25¢)

  Gives an account of the water transportation system of the Columbia and Snake rivers.

O *Oregon Wet High and Dry, by John Dart and Daniel Johnson. Obtain from Hapi Press, 512 Maplecrest Drive, Portland, OR.

A natural history of Oregon, this book includes information about geology, vegetation, soil types, wildlife, and so on.

O *Oregon's Smaller Ports: What They Do and How They Are Financed, by Wilson E. Schmisseur, et al. 1979. EC-979. Obtain from Mailing Services, Oregon State University, Corvallis, OR 97331. (25¢)

Surveys the smaller ports of Oregon, their responsibilities and functions, and their finances.

O *Politics and Economics of Columbia River Water. October 26, 1984. Conference proceedings. Obtain from Washington Sea Grant, 3716 Brooklyn Avenue, N.E., Seattle, WA 98105-6795. ($9.00)

Presents the political, economical, and technical questions that must be addressed in operating and managing the Columbia River system. Contributors include senators, department heads of federal and state agencies, major users, and key water managers. (130 pp.)

O *The Role of the Columbia/Snake Navigation System in Intermodel Ocean Transportation, by James R. Jones. ORESU-T-80-001. Obtain from Sea Grant Communications, AdS 402, Oregon State University, Corvallis, OR 97331. (Free)

Discusses the Columbia-Snake River navigation system and its potential as a major waterway; it also describes new techniques in transloading commodities aboard ocean vessels.

"The Snake River Country." Resource Inventory Map. Obtain from Washington Sea Grant, 1919 N.E. 78th Street, Vancouver, WA 98665. (Free)

This 17" x 23" map has a narrative which discusses the history and major uses of the Snake River. It outlines the river basin and identifies visitor centers, parks, museums, and historic sites situated along the river.

O The Dalles Lock and Dam, a pamphlet. Obtain from Portland District U.S. Army Corps of Engineers, 319 S.W. Pine, Portland, OR 97204. (Free)

Describes the operations, management, and multiple purposes of this Columbia River dam.

O *Waterway User Fees and Wheat Transportation in the Pacific Northwest, by Ken Casavant, et al. PNW #230. Obtain from Ag Publications, Washington State University, Pullman, WA 99164-5912. (25¢)

Describes wheat transportation within the Columbia River basin and the effects water user fees will have on barge and truck traffic.

- Write to ports such as Longview and Portland for pamphlets they print. Some also have slide programs they may provide.

- Write to your state department of tourism and local chambers of commerce for informational brochures that they may have in print.

Audio-Visual Materials

Material marked with a dagger is suitable mainly for grades 5-8; that marked with two daggers is more appropriate for grades 9-12.

† Estuary: Columbia's Link with the Sea. Available from Sea Grant
†† Communications, AdS 402, Oregon State University, Corvallis, OR 97331. This 28-minute 16mm film points out the importance of the Columbia River estuary. It also discusses the multiple uses of the Columbia and how they affect the estuary and individuals who use the estuary.

† Sparkle. Available from U.S.F.S., Dept. of Agriculture, P.O. Box 3623, Portland, OR 97202. A visual poem follows a wild mountain stream from its source high in a pristine side canyon of the gorge down to its meeting with man.

†† The Columbia River: A Time of Decision and a Question of Balance. 1981. Obtain from Washington Sea Grant, 1919 N.E. 78th Street, Vancouver, WA 98665.

This 15-minute slide-tape program presents an overview of the uses of the river and discusses the complexity, interrelatedness, and potential conflicts in using the river for multiple activities.

†† Livable Streams. A slide-tape set produced by the Bureau of Land Management suitable for 9th grade to adult. Covers the relation between land use and water quality in streams. Fifteen minutes. For information, contact the Bureau of Land Management, 729 N.E. Oregon, Portland, OR 97232.

†† Steamboats of the Columbia. Available from the Oregon Historical Society, 1230 S.W. Park, Portland, OR 97205. Slide program showing the importance and historical role of steamboats on the Columbia.

†† The Columbia River Gorge: A Natural History. Available from Northwest Film Study Center, 1219 S.W. Park Ave., Portland, OR 97205. Student-produced 16mm film which shows the formation of the gorge by floods. Also includes information about the natural history of the gorge.

†† Journey of the Kings. Available from Northwest Power Planning Council, 850 S.W. Broadway, Suite 1100, Portland, OR 97205 (free). (Ask for 15-minute version.) This 16mm film discusses the plight of the Columbia River salmon and the remarkable regional program designed to protect them. This beautiful movie soars over some of the most stunning landscapes in the world as it follows the salmon from their upriver spawning grounds, through the mighty dams, to the sea, and back again.

†† Pass Creek. Available from U.S. Fish & Wildlife Service, Lloyd 500 Building, Suite 1692, Portland, OR 97232. Describes the effects of careless logging on small streams. The Oregon setting relates the effect of logging on steelhead trout.

†† Dammed Forever. Available from U.S. Fish & Wildlife Service (see above), or U.S. Fish & Wildlife, P.O. Box 25486, Denver Federal Center, Denver, CO 80225. Traces the changes in major waterways and their streams when a series of dams is built. Shows the influence on wildlife and water quality. Focus is on fish life.

†† Columbia River Gillnetters. Available from Extension/Sea Grant, AdS 422, Oregon State University, Corvallis, OR 97331. Describes types of boats and nets and methods used in local gillnet fishery for salmon; identified areas fished; follows fish from catch to delivery to processor.

Other Resources

- Contact a local port for possible field trip, outside speaker, or written materials. For example, the Port of Portland offers the following:

- Tours of the Port
  Can be adapted to any age level. Requires groups of 20 or more.

- Van Program (Grades 3-5)
  A 38-foot trailer used to teach curriculum regarding the port and Oregon's role in international trade.

- Suitcase Program (Grades K-12)
  Guess What I Am (K-3): A discovery session for younger children.

  Careers in Marine Trade (7-12): Presentation of career possibilities at the port.

  Maritime History (5-12): Presentation of the history of the Columbia River and the growth of Portland as a major world seaport. Includes artifacts, slide presentation, and discussion.

- Speaker's Bureau (High School-Adult)
  A presentation of current issues facing the port.

- Contact a dam near you and arrange a tour, if your school district allows it. Students can watch a fish ladder in operation, see the turbines, learn about the spillway, and get some history on the development of the dam.

Introduction

Activity: Salt Dough Map

Concepts:

1. The Columbia River and its tributaries drain major portions of the Pacific Northwest (nearly 260,000 square miles).
2. The river originates in south-central British Columbia and travels more than 1,200 miles before entering the Pacific Ocean near Astoria, Oregon.

Objectives: The students will be able to

1. identify the Columbia River on a map of the Pacific Northwest.
2. name the countries and states in which the Columbia River system is found.
3. show on a student-made map the flow of the Columbia River.
4. define the terms "tributary" and "river system."

Teacher prep:

1. Read teacher information sheet.
2. Gather necessary materials.
3. Make an overhead transparency of the Columbia River map and duplicate copies of the map of the Columbia River basin for student use.
4. Mix the dough. Add water slowly. Dough should be thick, not sticky. Knead dough until smooth. Store in air-tight container.

Materials:

1. relief map of Pacific Northwest
2. 8 x 11½ sheet of cardboard for each student (Those found on the back of writing tablets work well.)
3. bowl
4. spoon
5. 2 cups salt
6. 2 cups flour } Yields enough dough for 30 students
7. ¼ cup water
8. poster or tempera paints
9. small paint brushes

Procedures:

1. Display a relief map of the Pacific Northwest. Ask student volunteers to find the Columbia River on the map. Ask students to find rivers which flow into the Columbia. Explain the term "tributary." Ask students to name the countries through which the Columbia River and its tributaries flow. Discuss the beginnings of the Columbia and trace its flow to the Pacific.

2. Distribute maps for reference. Distribute cardboard sheets to each student. Have students write their names on the back. Have the students sketch the Pacific Northwest in pencil on the cardboard sheets. Give each student a small amount of dough (approximately 2 T will complete the map). Instruct the

students to spread the dough thinly over the land portion of their map, leaving the Pacific Ocean untouched. Ask students to show mountain ranges by gently pinching up parts of the dough. Have students use a sharp pencil or pen to indent the map to show the Columbia River and its tributaries.

3. Allow the maps to dry overnight.

4. Have students paint their maps.

Extended activities:

Working with partners or in small groups, have students make larger, more detailed relief maps of the Columbia basin for a bulletin board display. Students may choose to use felt markers to color their two-dimensional maps or salt dough to make a three-dimensional map the size of a bulletin board. Students should include labels and map legends.

History

History: A Reading

The Columbia River begins in the mountains of eastern British Columbia, Canada. The Snake River begins in Yellowstone National Park in Wyoming. These two great rivers come together and become one near Pasco, Washington. Together they drain an area of over 250,000 square miles. This area includes most of Idaho, most of Washington and Oregon, the western third of Montana, small portions of Wyoming, Nevada, and Utah, and part of British Columbia. The land is equal in size to the nation of France. The river itself is over twice the size of the Nile River in Egypt and is second only to the Mississippi in water volume in the United States.

THE COLUMBIA/SNAKE DRAINAGE SYSTEM

People have lived along the banks of the Columbia for over 12,000 years. The oldest village in the Columbia area was found near The Dalles, Oregon. This village, known to the Indians as Wy-Am, is more than 10,000 years old.

The Indians who lived along the Columbia lived by fishing and trading. Some of the tribes that lived along the Columbia were the Chinooks, Sahaptin, Shoshone, Bannock, Nez Perce, and Paiutes. All of these tribes caught the salmon of the Columbia. Every year the tribes would meet at Wy-Am, near the fishing grounds of Celilo Falls, to trade. There, the natives of the interior traded dried salmon, hides, and baskets for shells and woven bark of the coastal tribes. This culture flourished for thousands of years until the early 19th century, when settlers from the east came. They would completely change this ancient way of life.

WISHRAM DIPNETTER

In 1805, Captains Lewis and Clark, on a mission from President Jefferson, entered the Snake-Columbia Region. After them, other explorers came. Astoria was started in 1811 and fur trappers began making their way along the Snake River. Fort Vancouver was started by England's Hudson Bay Company in 1825.

The Mountain Men made their living on fur trade all along the Snake. Jedediah Smith and his men took a hot, dry route from the Rockies to California and up into Oregon from the South.

In the 1830s, Missionaries Jason Lee, David Lee, and Marcus Whitman brought Christianity and farming to the region.

Wagon trains followed, bringing settlers 2,000 miles over the rough Oregon Trail; more and more followed, bringing United States' customs and ways to the region.

These settlers began to claim the land for themselves, changing the Indian ways. They also brought disease which killed most of the Indians, and plows which tore up their land.

Afraid of disease, disgusted with the plow and land claims, some of the natives fought back. Because they fought against the taking of their land, they were put on reservations. The United States continued to grow and move west. Some nations in the

Oregon Territory, like England and France, left the area. Other nations, like the Chinook and Sahaptin, were defeated because they had no other place to go.

Early Indian Tribes of the Northwest

Activity: History Filmstrips

Concepts:
1. The Columbia River was the last major waterway discovered and explored in the U.S.
2. Indian culture has flourished along the banks of the Columbia for over 12,000 years.
3. Many explorers, fur traders, and missionaries are known for their part in developing this region.

Objectives: The students will be able to
1. define "explorer," "fur trader," "missionary."
2. name several famous persons of historical significance to the Columbia River region.
3. illustrate, in detail, the importance of explorers, fur traders, or Indians to this region.

Teacher prep:
1. Gather necessary materials.
2. Make student copies of filmstrip guide sheet.

Materials:
1. fine-tipped permanent marking pens
2. blank film strip (about 12 inches per student)
3. film strip guide sheet for each student
4. encyclopedias, library books, other research materials on the history of the Columbia River region
5. 15-minute blank cassettes (optional)

Procedure:

1. Ask students to name any famous persons they can that lived or worked in the Columbia River region long ago. List the names on the board. If the students cannot think of specific names, ask them what kind of persons would have been important in the development of the Columbia River area. List the kinds of persons as categories on the board. Beneath each category write the names of these famous persons and any others thought of by your class. When discussing the Indians, point out that several different tribes from two different nations were found in this region.

Missionaries	Explorers	Indians	Fur Traders
Jason Lee	David Thompson	Chinook nation	John Jacob Astor
Daniel Lee	Robert Gray	Sahaptin people	Dr. John McLoughlin
Marcus Whitman	Lt. William Broughton		
	Capt. George Vancouver		
	Meriwether Lewis		
	William Clark		
	John Townsend		

2. Ask students to choose one category (or you might assign students to ensure that each topic is covered). Give them an opportunity to research their topic and write a one-page report on the topic. After you have okayed each report, distribute filmstrip materials. Have students use their report as the narrative for the filmstrip. Show students how to make a title frame (writing clearly, neatly, and very small) for their filmstrip and then how to advance the film through the guide to draw illustrations to go with the narrative. Encourage students to make illustrations which fill each frame and are as detailed as possible. When the filmstrip is complete, you might want to have students record their narrative on cassettes. (Be sure they record a belltone to signal when to turn the filmstrip.)

3. Have a Columbia River filmstrip festival. Give students an opportunity to show their completed filmstrips to the class. You might share your filmstrips with other classrooms or invite parents in to view the finished products.

Extended Activities:

1. Have interested students research the settlers of the Columbia River region. How did they get to this area? Where did they come from? What dangers did they face in their travels? Students could write their findings in diary form.

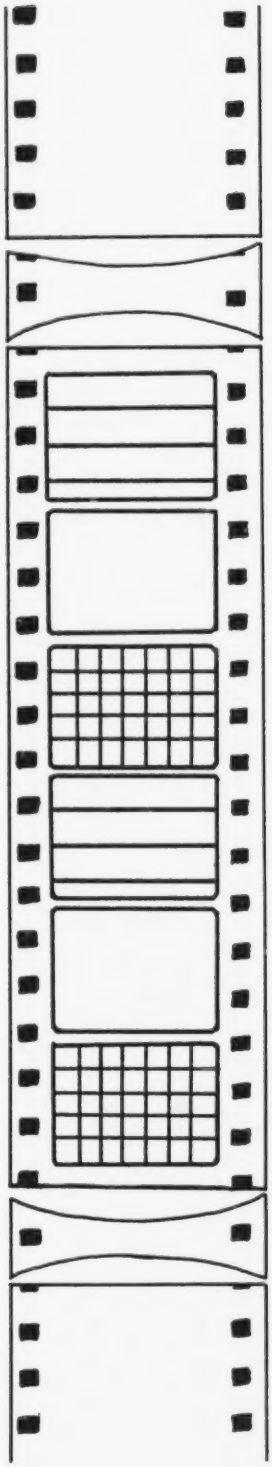
2. Students interested in Indian culture could try their hands at beadwork or basketweaving. You might find an expert in your community who could work with these students or do a presentation for your entire class.

Before using, cut out the blackened slits.

Thread the film through these so that the film lays on top of the guide frames.

Note the small guide marks on the left side between sprocket holes. Mark these on your filmstrip right away, then use them as guides when moving up your filmstrip.

Use permanent magic markers to draw images.



Tip: Use big, bold areas of bright color.

Tip: Color in the background with a light-colored, wide-tipped marker, then draw the picture with darker, fine-tipped markers.

Always start with the lightest color first and end with the darkest. Otherwise, the darker color may smudge.

Do each drawing in one frame or rectangle. Use whichever guidelines are most useful.

Filmstrip "U" film is available from any audio-visual equipment and supply house, such as:

Highsmith Co., Inc.
P.O. Box 800
Highway 106 East
Fort Atkinson, WI 53538
(415)563-9571

The approximate cost for a 25-foot roll of film is $4.65.

Activity: Indian Legends--Puppet Plays

Concepts:
1. The Columbia River Indians used legends to explain major features of their environment.
2. The Columbia River Indians developed a complex culture including legends and other art forms.

Objectives: The students will be able to
1. define the term "legend."
2. tell how legends were shared and passed on among the Indians.
3. retell an Indian legend.

Teacher prep:
1. Duplicate copies of the reading selections for each student.
2. Duplicate puppet patterns.
3. Gather necessary materials.

Materials:
1. class set of student reading selections
2. felt squares of various colors
3. yarn
4. glue
5. scraps of cloth, lace, trim
6. fine-tipped permanent markers
7. cotton swabs
8. butcher paper

Procedures:

1. Distribute part one of the reading selection. Have students read orally the Indian legends. Ask students to look for the main characters in each. Ask students the main idea of each story. Explain that these stories are part of the culture of Columbia River Indians. Explain that these stories were told for a reason. Ask students the purpose of stories such as these. Ask students to define "legend." Ask students how they think legends were shared by the Indians. Distribute part two of the reading selection. Read and discuss with the class. Stress that legends 1) were an important part of Indian life; b) were passed on to other people through storytelling, dancing, singing, paintings, and carvings; and c) explained the natural surroundings or environment.

2. Ask students to pick their favorite Indian legend. Divide the class into small groups based on the legend chosen. Have students write a script for a puppet play of their legend.

3. Distribute the puppet patterns and instructions. Make available the necessary materials. Have students make felt finger puppets of the characters in their play, following the printed instructions.

4. Give the students time to practice their plays with their finished puppets. Encourage them to make scenery by drawing or painting backgrounds on butcher paper.

5. Have students present their plays to the class. Share the plays with other classrooms.

Extended activities:

1. Have students create their own legends to explain (1) why salmon travel to the ocean and back upstream to spawn, (2) why the wind blows in the Columbia River Gorge, (3) why the Columbia River flows to the Pacific Ocean, or (4) why eels are found in the Columbia River. Have students share their legends with the class.

2. Have students make soap carvings of the major characters of one Indian legend. Have the students write their version of the legend on an index card. Display the carvings and legends in a prominent place in the classroom or school.

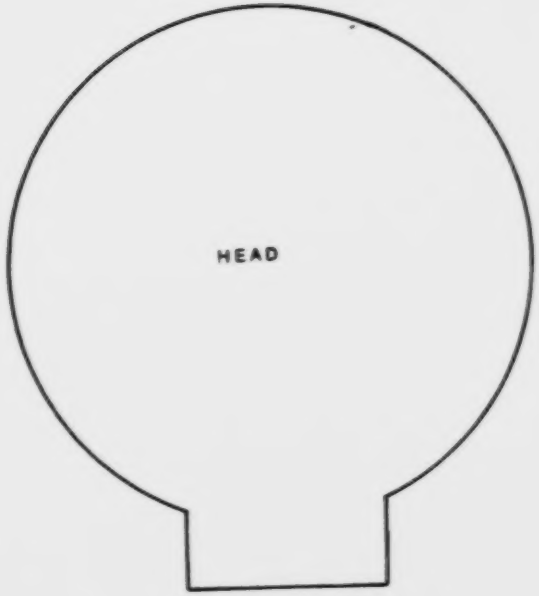
Puppet Instructions

Imagine what your character looks like. Choose the right color felt to match the skin or fur of your character. Cut two body pieces (A). Overlap the sides of the body. Glue the pieces together, leaving the top and bottom open. (These patterns make a human puppet. If you are not making a person, change the shape of the head, arms and hands to look like your character.) Cut two arms (B), two hands (C), and two heads (D).

Glue the arm pieces together with hands between them. Glue the arms to the back of the body. Put a cotton swab between head pieces and glue together.

Push the other end of the swab into the neck opening of the body. Glue the head to the body.

Dress the puppets using yarn, lace, trim, and other materials to look like the characters you have chosen.



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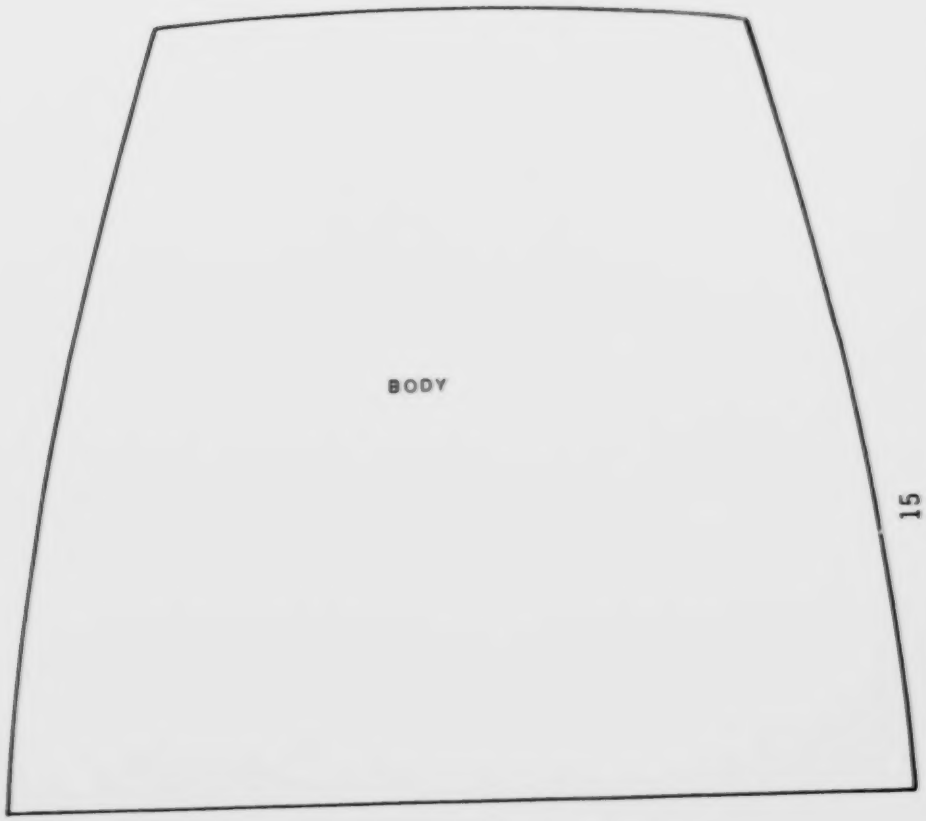

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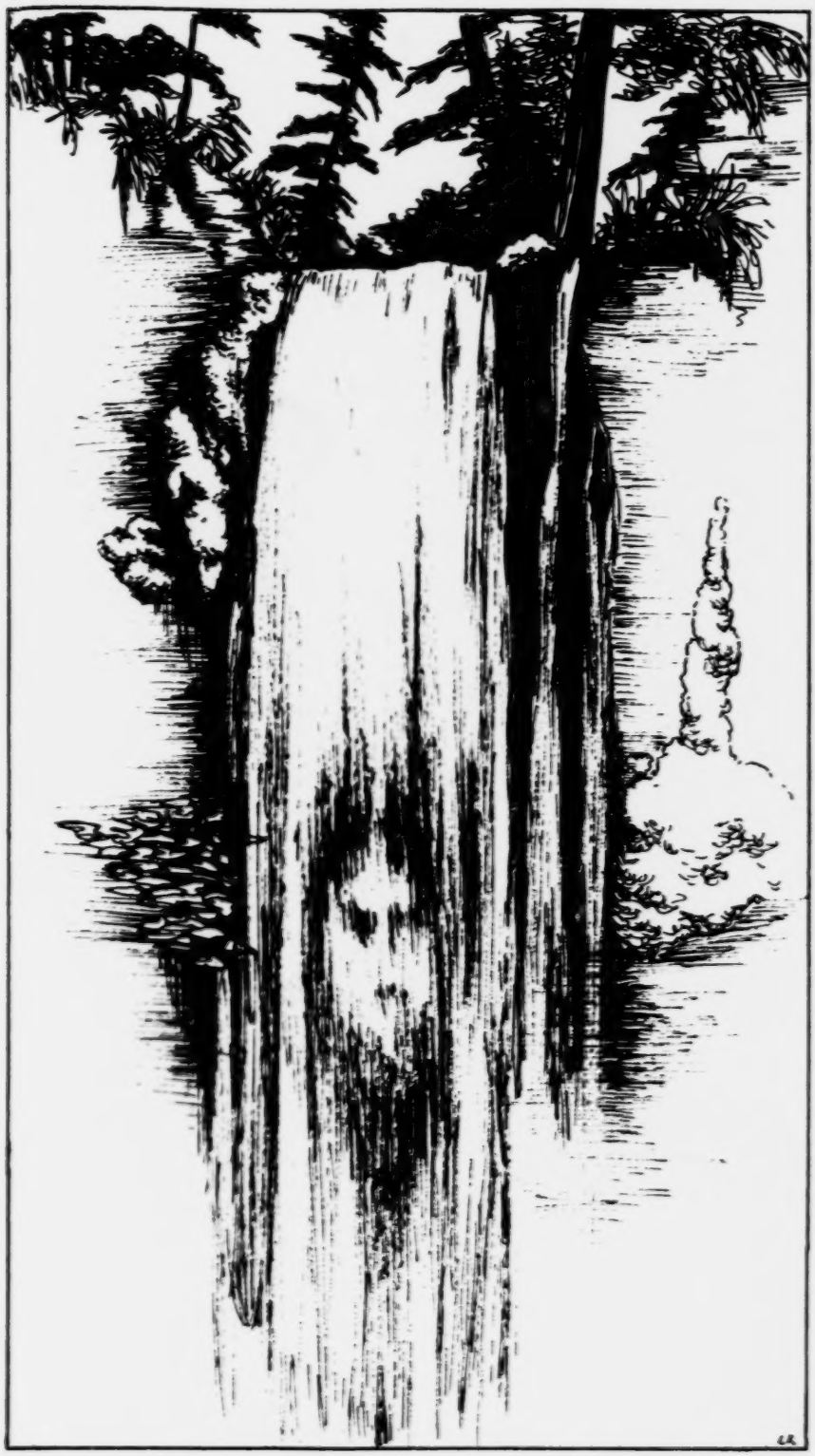
The Legend of Multnomah Falls

Many years ago, a terrible sickness came over the village of the Multnomah people and many people died. An old medicine man of the tribe told the chief of the Multnomahs that a pure and innocent maiden must go to a high cliff above the Big River and throw herself on the rocks below. Then, the sickness would leave at once.

The chief did not want to ask any maiden to make the sacrifice; but, when the chief's daughter saw the sickness on the face of her lover, she went to the high cliff and threw herself on the rocks below. The sickness passed away.

As a token of the maiden's welcome by the Great Spirit, a stream of water, silver-white, streamed over the cliff. The stream broke into a floating mist along the face of the cliff. Even today, as you carefully watch, the maiden's face can be seen in the upper waterfall. You can see the breeze gently rustle the watery strands of her silken hair.



Guardians of the Columbia*

The old men of the tribes say it was Tyhee Saghalie, chief of all the gods, who put the Guardians of the Columbia there, and they say it was an act of harsh justice tempered by the melancholy of a tired old man whose sons took up arms against each other.

They say Tyhee Saghalie and his two hot-tempered sons came down the river from the far north in search of a land suitable for the Tyhee of all gods, and after a long, arduous trip that was difficult even for a god, they found the land beside the river where the rocks were like stepping stones, which the white men named The Dalles.

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*There are many legends about the Bridge of the Gods. This land bridge was claimed to span the Columbia River near present-day Cascade Locks, Oregon. Various Indian tribes living in the Gorge had their own version. This version comes from the Klickitat Indians.

They had never seen a land so beautiful, and Tyhee Saghalie made it his own. But his two sons quarreled over the possession of that land, and Tyhee Saghalie settled the dispute by shooting two arrows from his powerful bow--one to the west and one to the north. One son, Klickitat, followed the arrow to the north and made it his land and became the grandfather of a tribe named for himself. The other son, Wy-east, followed the arrow to the west and became the grandfather of the Multnomahs, who lived beside the river called Willamette.

Then Tyhee Saghalie raised the mountains on both sides of the river for a boundary between the sons' land, but he did not raise any high enough to have a cap of snow, perhaps remembering the cold of the far north. Then he built the most beautiful structure man had ever seen--Tahmahnawis, the Bridge of the Gods--so that his sons and their children might pass across the river in safety and that his family might not always be divided.

Then Tyhee Saghalie did a good thing that led to the destruction of his family. On the river lived a witchwoman, Loowit, who was the ugliest of the ugly crones. But being a woman, Loowit had a way to make herself needed and wanted: she had charge of the only fire in the world.

She saw how miserable the tribes on both sides of the river were during the long, wet winters with no fire to keep them warm or to cook their fish and venison. It hurt Loowit's heart to see the women always cold and wet and to see the little children sick and dying.

So one day she made a gift of the fire to Tyhee Saghalie. His gratitude was without limit, and he offered Loowit anything she wanted.

She asked what any ugly woman would ask and she became the most beautiful maiden in the world. All the young men fell in love with her, but she paid them no attention.

Then she met Tyhee's sons, Klickitat and Wy-east. She could not decide which to marry, and their tribes quarreled among themselves over which of their chiefs should have Loowit's hand. Soon war broke out between the brothers' people.

Tyhee Saghalie was sad and angry. He knew that to end the fighting he must destroy the cause. First he destroyed the Bridge of the Gods. Then he put Loowit, Wy-east, and Klickitat to death.

But he felt responsible for the tragedy, and he loved all three he had put to death. Because they were beautiful in life, he wanted them to be admired forever.

He made Wy-east into Mt. Hood, Klickitat into Mt. Adams, and Loowit into Mt. St. Helens.

And the rocks from the Bridge of the Gods that fell into the river created the great Cascades.

From Archie Satterfield's Moods of the Columbia (Seattle: Superior Press, 1968).

The Legend of Rain and the Cascade Mountain Range

When the world was still young, Rain lived out in the Pacific Ocean. He sent rain clouds with plenty of moisture for all the lands west of the Rockies.

Streams flowed with water, fish were plentiful, and trees and plants grew everywhere. The fields were green and full of wildlife. The Indians had plenty of food, and they were happy.

Coyote lived east of where the Cascade Mountains now stand. He wanted another wife, and so he asked Beaver's beautiful daughter to marry him. She refused. In revenge, Coyote sought help from Wind. Now, Beaver's daughter lived near the coast in the streams of clear water. Wind blew the clouds past the western land where she lived and over to Coyote's land. This left the coast lands without any moisture. Plants and trees died, the streams became dry, and the fish vanished.

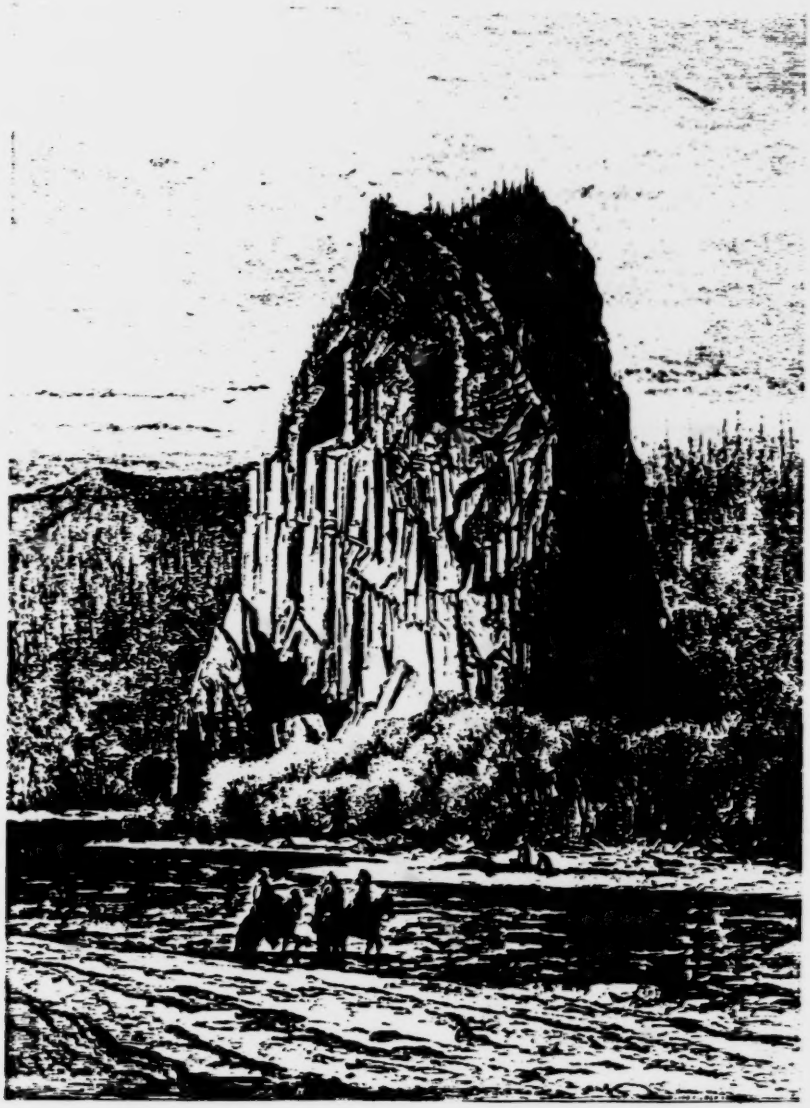
"Our land is drying up," cried Beaver's people. They asked Rain to help them.

Rain then sent his beautiful daughter Mist to plead with Coyote. Coyote wanted Mist to be his wife. He tried to hug and kiss her, but she was so soft Coyote could not hold her. She slipped away from him and returned to her father. Rain was very angry with Coyote. He called upon the Great Earth Spirit to build a wall of mountains so that Coyote and Wind could not steal all the clouds. In response, the Great Earth Spirit formed the Cascade mountain range. Now the western slope has moisture, and east of the mountains it is dry.

Adapted from Jim Attwell's Tahmahnaw: The Bridge of the Gods (Skamania, WA: Tahlkie Books, 1973).

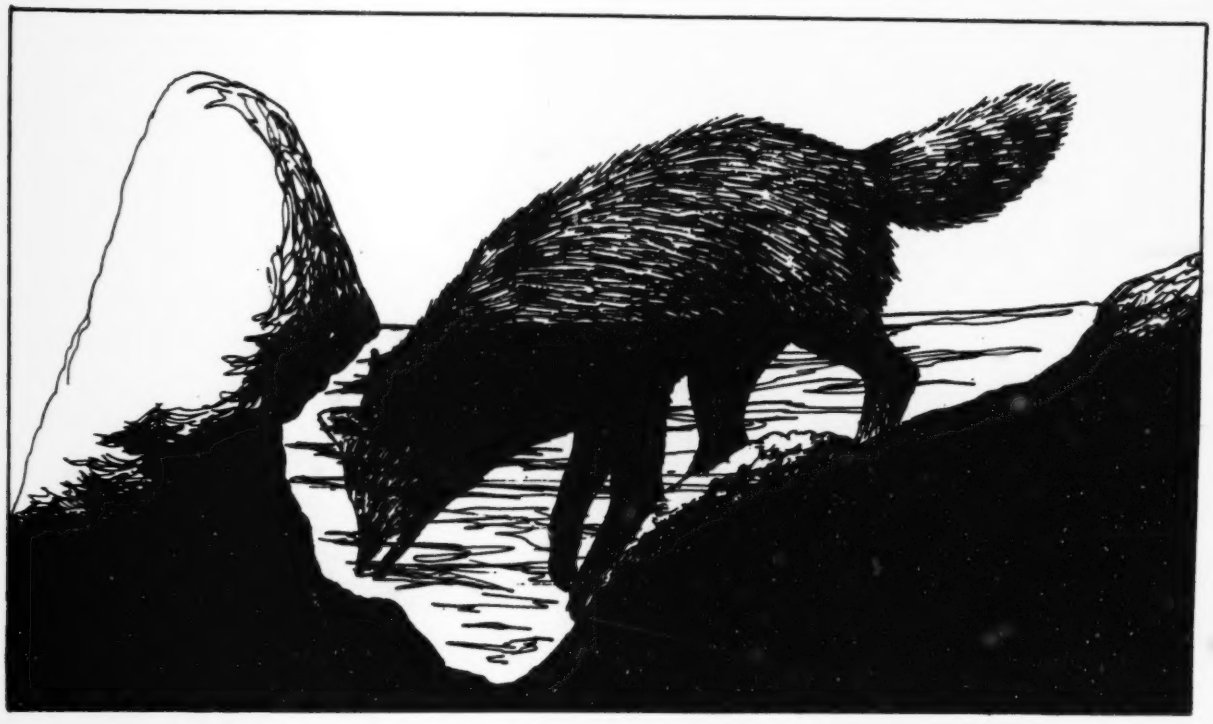
The Legend of Beacon Rock

Once there was a young Indian princess named Wehatpolitan. She made her father, the chief, angry when she married a young brave. The Indian princess and her husband had a baby boy. Then the chief and his sons killed the princess' husband. Wehatpolitan took her baby and ran away to Beacon Rock. She climbed to the top of the rock. There, she and her son died. Some Indians say that even now if you stand at the foot of Beacon Rock and listen you may hear the baby cry.



1871 Etching of Beacon Rock

Coyote Takes Water from the Frog People



Coyote was out hunting when he found a dead deer. One of the deer's rib bones looked like a big dentalia shell. Coyote picked it up and took it with him to see the Frog People. The Frog People had all the water. When anyone wanted water to drink, to cook with, or to wash with, he or she had to get it from the Frog People.

Coyote said, "Hey, Frog People, I have a big dentalia shell. I want a big drink of water, and I want to drink it for a long time." "Give us that shell," said the Frog People, "and you can drink all you want." Coyote gave them the shell and began drinking. The water that Coyote drank was behind a large dam.

Coyote began drinking. He drank for a long time. Finally, one of the Frog People said, "Hey, Coyote, you sure are drinking a lot of water there. What are you doing that for?" Coyote brought his head up out of the water. "I'm thirsty."

After a while one of the Frog People said, "Coyote, you sure are drinking a lot of water. Maybe you had better give us another shell." "Just let me finish this drink," said Coyote, putting his head back under the water. The Frog People wondered how coyote could drink so much water. They thought Coyote might be trying to trick them.

All the time he had his head underwater, Coyote was digging out under the dam. When he was finished, he stood up and said, "That was a good drink. That was just what I needed." Then the dam collapsed and the water went out into the valley and made the creeks and rivers and waterfalls. The Frog People were very angry. "You have taken all the water, Coyote!" Coyote said, "It is not right that one people have all the water. Now it is where everyone can have it."

Now, anyone can go down to the river and swim or get water to drink or to cook with.

Indian Legends--Part II: A Reading

What is a legend?

From the stories you have read, you can see that a legend is a special type of story. It is based on fact and told as though it were true. It centers around an actual person or place or event.

Why were legends told?

These stories were told to explain the natural surroundings or environment of the story tellers and listeners. The legend of the Guardians of the Columbia, for example, explained why Mt. St. Helens, Mt. Adams, and Mt. Hood are found in the Pacific Northwest.

How were legends shared?

The word "legend" comes from the Latin "legendus," which means "to be read." But the Indians did not write out their legends for others to read. Instead, the Indians of the Columbia shared their legends and passed them on to others in several interesting ways. They told their legends as stories around the fire. Sometimes legends were acted out in dances. Legends were also told through songs. The Indians of the Columbia also painted pictures of their legends. They made petroglyphs, or rock carvings, to share their legends with others.

Teacher Resource:

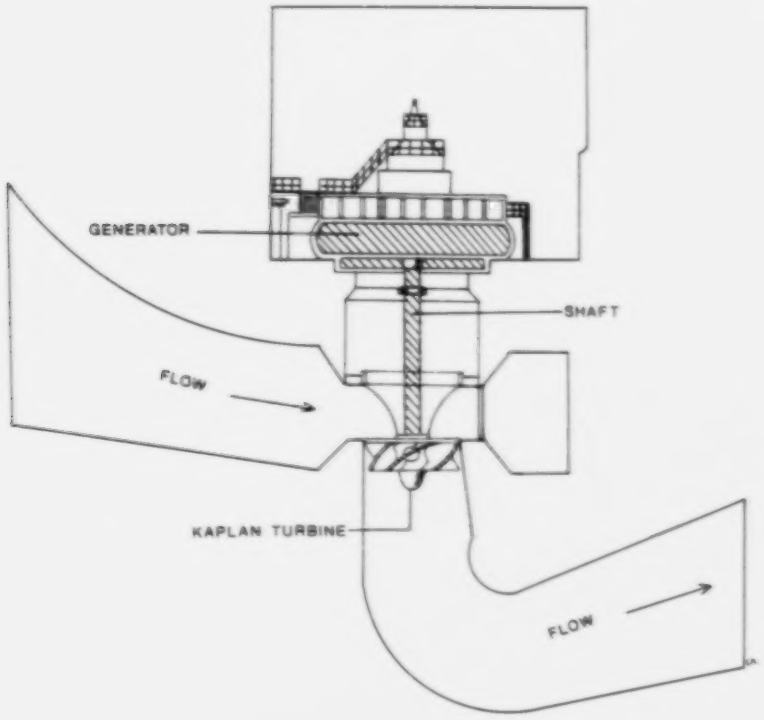
American Indian Legends
(6 color filmstrips with cassettes)
Coronet Instructional Media
65 East South Water St.
Chicago, IL 60601

Energy

Hydropower: A Reading

Years ago, waterwheels were used to turn machinery to grind grain and sharpen tools, but waterwheels were slow and could power only one machine at a time. In the early 1800s, a new kind of waterwheel was invented. It was the turbine.

The turbine is a wheel with fan blades. Flowing water hits the blades to spin the wheel. Forceful, flowing water is needed to turn a turbine. Forceful, flowing water can be produced when water falls from a great height. Turbines may be powered by natural waterfalls, or as in the Columbia River system, by artificial waterfalls.

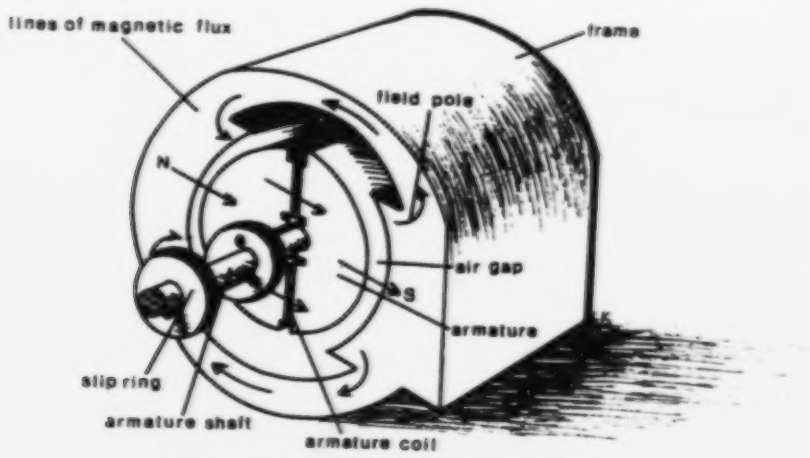


How is an artificial waterfall made? On the Columbia River and its tributaries, dams have been built to trap water. The water is then released to create a waterfall. The water is dropped down from the top of the dams through flow intake tubes.

These are huge pipes leading into the turbine. Valves and pumps are used to control how much water reaches the turbines.

The flowing water turns the turbines. The turbines are connected to a generator. The turning turbine spins the generators. Electricity is produced by the spinning generator. The electricity is formed as alternating current and is sent out over transmission lines to where it is needed.

ELEMENTARY GENERATOR



Whenever you turn on your TV set, flick on the lights, or cook your dinner, a turbine goes to work for you. But, as you are watching or cooking, the water which must pass through the dam to produce the electricity moves down the stream and may be lost for other uses. For example, a tug boat waiting to move upstream may not have enough water to fill a lock to lift it over the dam. A farmer in eastern Washington may not have enough water to sprinkle on his field of peas. Or the salmon migrating upstream to spawn may not have enough water to complete its journey.

The Dalles dam is one of those huge dams erected on the Columbia River to turn turbines. It can produce enough electricity for two cities the size of Seattle. It is hard to believe that there is not enough water in the Columbia to provide

for all its different uses. But, soon it will be possible to use every drop of water in the Columbia River system to turn turbines. We also need the water to water all the crops we want, to move tugs and barges up and down the Columbia, and to provide for the salmon we like to catch. We must plan carefully how we use the water so that all will have a share.

Activity: Hydropower--Waterwheel and Bicycle

Concepts:

1. Water is a source of energy.
2. Flowing water can turn a turbine to spin a generator.
3. The Columbia River system supplies the Pacific Northwest with most of its energy needs.

Objectives:

The students will be able to

1. define "hydropower."
2. explain how water can be used to produce electricity.
3. construct a waterwheel.

Teacher prep:

1. Gather materials.
2. Make an overhead transparency or student copies of hydropower illustrations.
3. Make student copies of reading selection.
4. Make a tagboard waterwheel pattern for each student.
5. Make an overhead transparency or student copies of a map of dams.

Materials:

1. class sets of hydropower reading selection
2. overhead transparency or student copies of hydropower illustrations
3. tagboard
4. straight pins
5. scissors
6. bicycle with generator and headlight (check with your students or local bike shop)
7. classroom faucet
8. optional: used bike generator (available at most bike shops for less than $5)

Procedures:

1. Ask a student volunteer to define "hydropower." Explain that you will explore the meaning of hydropower through an experiment.

2. Bring in a bicycle with a generator and headlight. (If possible, use one belonging to a class member and involve that student in the demonstration.) Have a student turn the wheel to make the electricity to light the headlight. Ask students to explain how turning the wheel produces power to light the headlight. If possible, dismantle a used generator to show the students its inner workings or draw the insides on the board.

3. Distribute waterwheel patterns. Have students follow the instructions to construct the wheel. Give students an opportunity to use the classroom faucet to turn their wheels. Ask students how water could be used to make electricity.

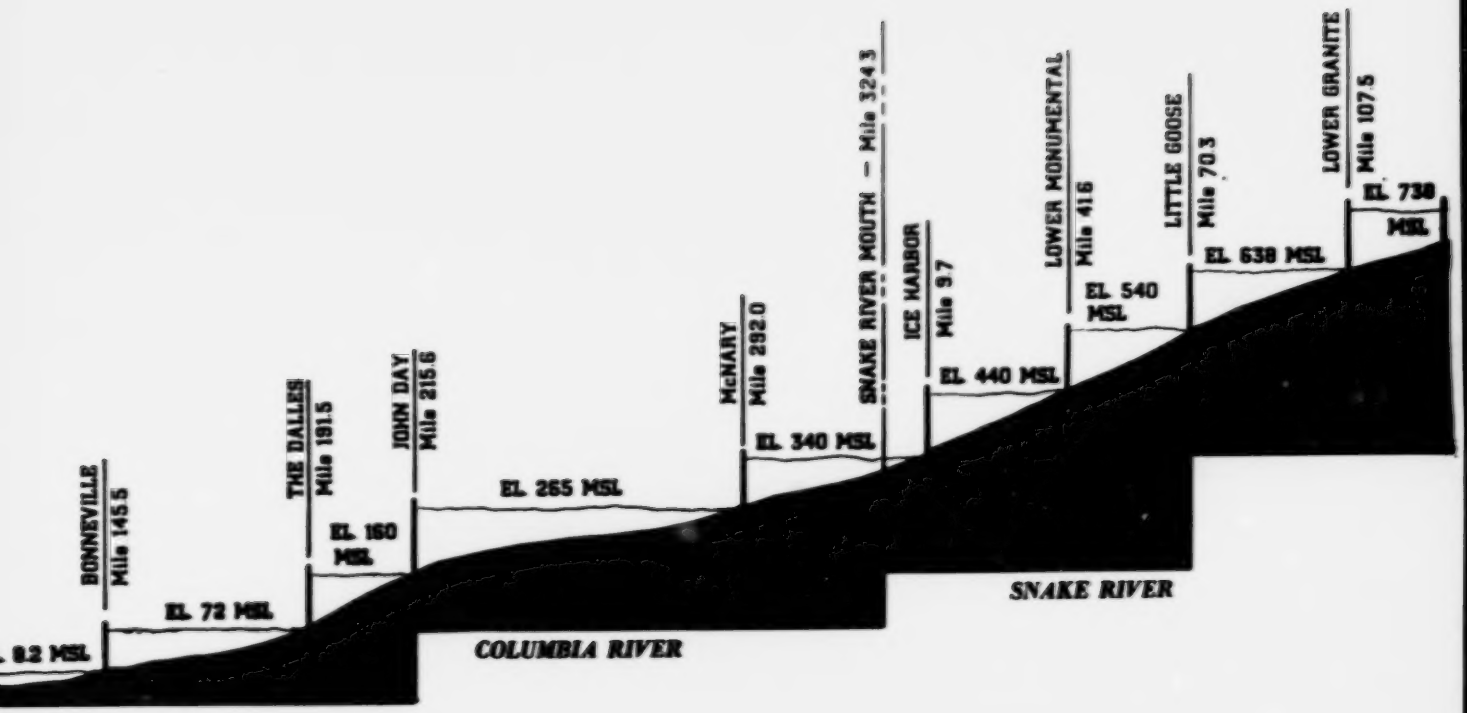
4. Distribute the reading selection. Have students read orally. Trace the production of electricity through the illustrations. Point out on the overhead transparency or student copy of the illustrations how turbines are like giant waterwheels which run generators to produce electricity.

5. Show students the overhead transparency of the map of Columbia River dams, or distribute student copies. Point out the great number of dams (38 major projects) constructed for electrical power. Ask students why the Columbia might be suitable for such dams. Show the side view of the river, illustrating the elevation of the dams. Stress that the topography of the Columbia River area follows for dams to be built on a narrow, powerful river and create the waterfall necessary to turn the turbines.

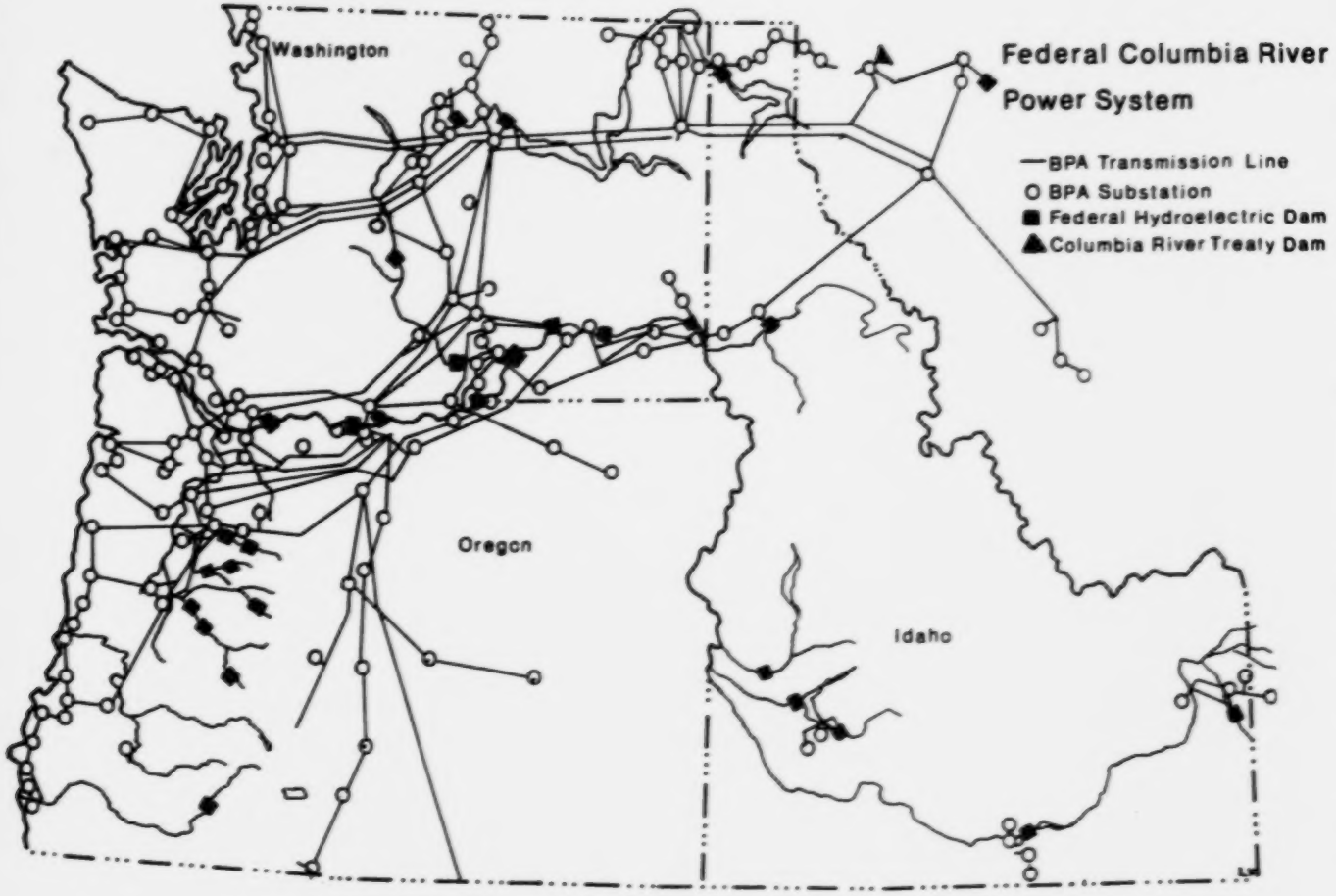
Extended activities:

1. Have interested students make a waterwheel using the end of a tin can (it will last longer than the tagboard one). Challenge them to use this waterwheel to light the bicycle headlight.

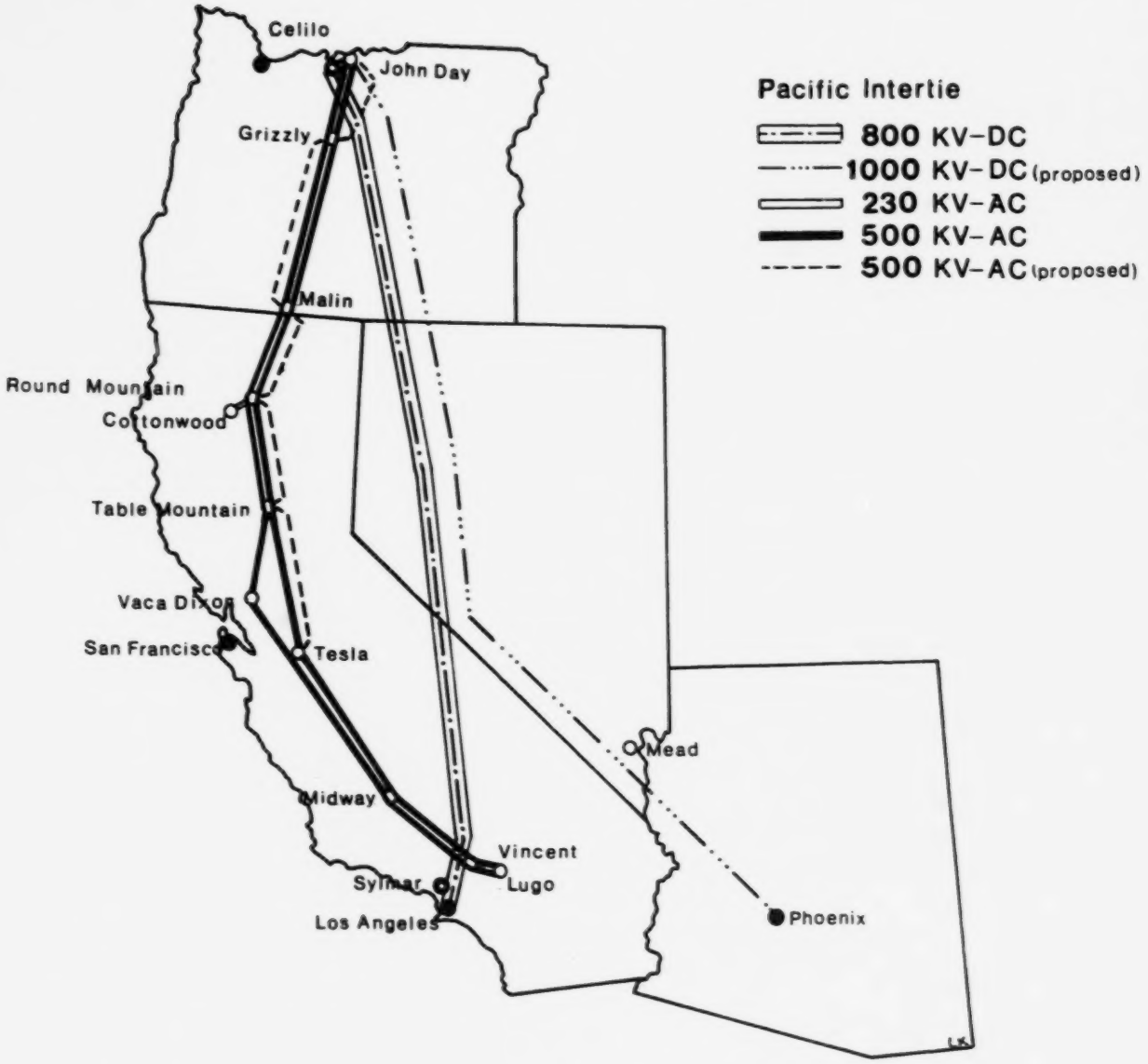
2. Have students contact the nearest energy extension agent to research micro hydropower systems. Have students report their findings to the class.

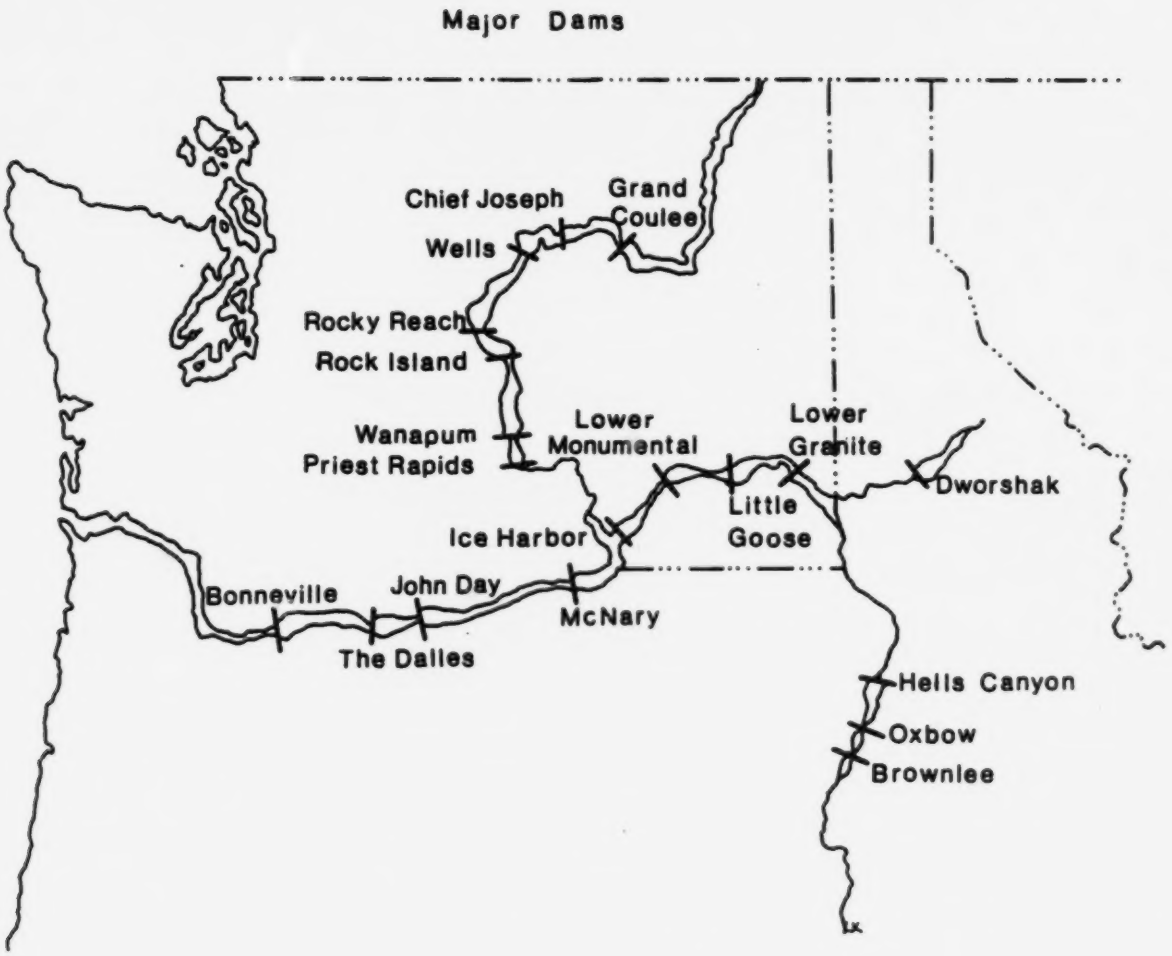


Side View of the Columbia and Snake Rivers


Federal Columbia River
Power System
—BPA Transmission Line
O BPA Substation
■ Federal Hydroelectric Dam
▲Columbia River Treaty Dam
Washington
Oregon
Idaho

POWER TRANSMISSION




Major Dams
Chief Joseph
Grand Coulee
Wells
Rocky Reach
Rock Island
Wanapum
Priest Rapids
Lower Monumental
Lower Granite
Dworshak
Little Goose
Ice Harbor
Bonneville
John Day
McNary
The Dalles
Hells Canyon
Oxbow
Brownlee

Activity: Brainstorming--Uses of Electricity/Crossword Puzzles

Concepts:
1. Hydropower produces electricity which is used in many ways by the people of the Columbia River area.
2. Power demands are increasing.
3. Water held back to meet energy demands means losses to other potential uses.

Teacher prep:
1. Make student copies of the reading selection.
2. Gather materials.

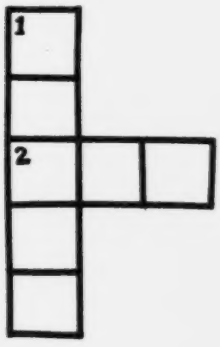
Materials:
1. reading selection
2. graph paper (two sheets per student)

Procedure:

1. Ask students to think of all the ways they use electricity in their homes. List their responses on the board. Ask students to think of all the ways electricity is used at school. List their responses on the board. Ask students to think of all the other ways electricity is used in their town. List their responses on the board. Review how the Columbia River system water is used to produce electricity. Ask students what they think might happen as more electricity is needed in the future. How could we make more electricity to supply the power needed by more people, new businesses, new appliances?

2. Distribute the student reading selection. Have students read the selection orally. During your discussion of the reading, stress the conflict of water uses and the difficulty of making decisions about who gets how much water.

3. Draw the following crossword puzzle section on the board. Have students solve this puzzle. Then distribute the graph paper. Ask students to make a hydropower crossword puzzle. Words used in the puzzle must have something to do with making electricity by water, using the electricity made, or making the decisions about who gets how much water. Have students make two copies of their puzzles, one with the answers filled in the squares and one with the squares empty.



Down
1. Making electricity by using flowing water is _____ power. (HYDRO)

Across
2. Built to slow the flow of water and create an artificial waterfall. (DAM)

4. Duplicate completed puzzles. Give students an opportunity to try to solve the puzzles created by their classmates.

Extended activities:

Have students make a collage of pictures cut from magazines which show ways we use electricity. Have students cover a bulletin board or large sheet of tagboard with pictures. Have students label their collage, "Ways We Use Hydropower," or something similar.

Fisheries

Fisheries: A Reading

Many kinds of fish can be found in the Columbia River system. The largest fish in the United States, the white sturgeon, is found in the Columbia and Snake Rivers. Other common fish found in the area include shad, lamprey, squawfish, bass, mountain whitefish, and yellow perch.

Salmon are the most valuable fish caught in the Columbia system. Commercial fishermen earn money by catching salmon and selling them. Sport fishermen catch the salmon for fun or for food. Indian fishermen also catch salmon for special ceremonies and for food. Chinook, coho, sockeye, and chum salmon are kinds of salmon that are found in the Columbia.

Salmon are an unusual fish. They are anadromous. That means they lay their eggs in fresh water, the young hatch, and then they migrate to the ocean, where they spend most of their life. They then return to their original spawning area once again to lay their eggs.

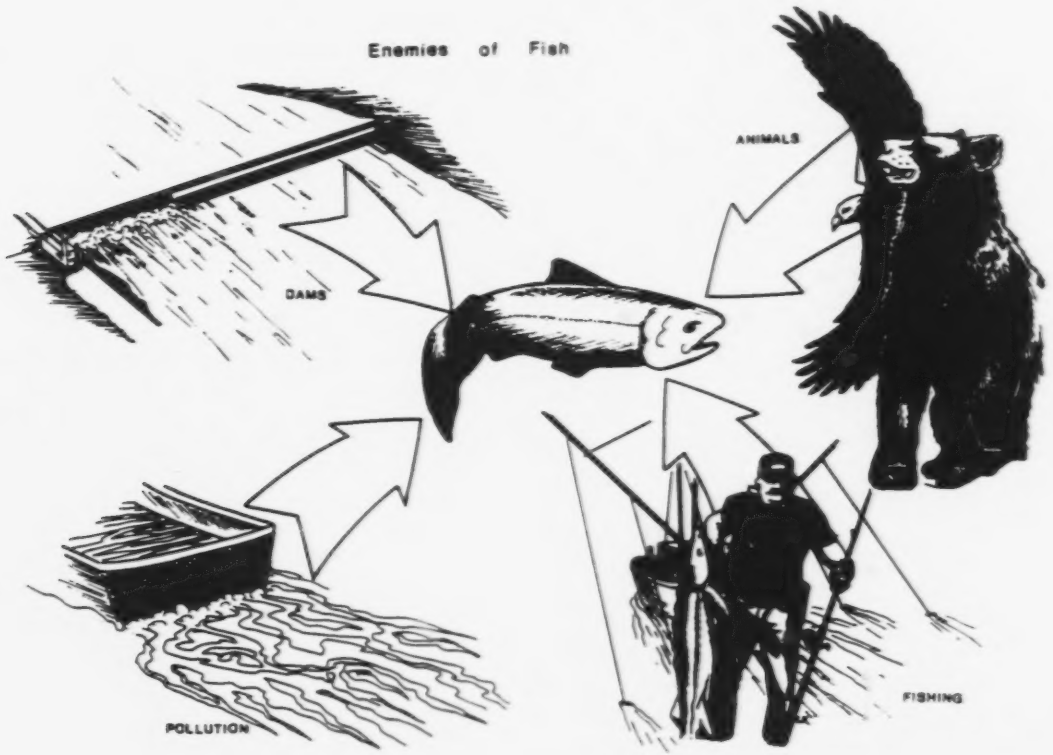
Once the Columbia-Snake River system was the most productive salmon and steelhead area in the world. In 1883, 43 million pounds of chinook salmon were caught. Since that time, the catch of salmon has dropped to only about 5 million pounds each year. This catch includes all types of salmon put together. Fewer fish were caught for several reasons. Commercial fishermen overfished the rivers, and poor land practices in mining, forestry, and agriculture destroyed many spawning areas which reduced the salmon stock. After the 1930s, even fewer fish were caught because dams were built. Some dams, like the Grand Coulee, were built without fish ladders. Fish could not swim past these dams to their spawning grounds.

Dams caused other problems for salmon. Dams slow the flow of the river. This makes it take longer for young fish to swim down to the ocean. If the young fish take too long to reach the ocean, they will die. Adult salmon swimming upriver to spawn

also are slowed by dams and fish ladders. Some do not reach their spawning grounds in time to spawn. Passing through the dams is another big problem for salmon. At each dam, 5 to 15 out of every 100 fish swimming downstream die going through the dam's turbines. It has been estimated that only 1 percent of the salmon which begin life survive to return to their home spawning grounds to reproduce--only 1 percent! Today, the government and Indian tribes are working to improve the chances for the salmon in the Columbia River.

When we are faced with making decisions about how to best use the water in the Columbia system and deciding who gets how much water, we will need to think about these fish. How much water do these fish need to live? How fast must that water flow? How will dams change the life of the fish? How will irrigation change the river? How will waste disposal change the water?

What will other uses of the river do to the fish? Who benefits from fish being in the river system? Is it important to keep salmon and other fish in the river system?



Activity: Tissue Paper Fish

Concepts:
1. A variety of fish can be found in the Columbia River system.
2. The catch of salmon has declined greatly over the years.
3. The Columbia-Snake system was once the best salmon and steelhead area in the world.
4. Fisheries need to be considered in making decisions about the uses of Columbia River water.

Objectives: The students will be able to
1. name several fish found in the Columbia system.
2. draw different fish found in the river.
3. tell how dams affect anadromous fish.
4. tell how other river uses affect fish.

Teacher prep:
1. Make overhead transparencies of student copies of illustrations of different types of Columbia River fish and copies of the fisheries reading selection.
2. Gather necessary materials.

Materials:
1. student reading selection on fisheries
2. illustrations of different Columbia River fish
3. sheets of colored tissue paper
4. glue
5. scissors
6. string
7. felt markers

Procedures:

1. Distribute student reading selections. Have students read orally the selection on fisheries. When different fish are mentioned, have students find them in the illustrations. Discuss problems for fish caused by dams and other uses of the river. Ask students to think of other problems besides those mentioned in the reading (predator fish eating anadromous fish as they are slowed up at the dams, sport anglers and commercial fishermen catching fish, water pollution from irrigation and waste disposal). Define and discuss "preserve, protect, and enhance."

2. Ask students to choose one fish found in the Columbia-Snake system. Distribute sheets of colored tissue paper (it comes in 28" x 32" size). Have students fold the sheets in half. Then have students sketch in pencil the outline of their chosen fish. Remind students to include fins. Ask them to carefully cut through both thicknesses of tissue. The students can then use felt markers to draw details such as eyes and scales. Have students glue the two tissue fish together just along the

outside edge, leaving a small section unglued. When the glue is dry, have students use the scraps left from cutting out their fish to stuff the fish. Some extra tissue may be necessary to make plump fish. Next, have students finish gluing the edges of the fish together. Then attach a piece of string to the center of the fish's back and hang the fish around your classroom. You might want to hang a label from the bottom of each fish to identify the species. These hang well from classroom lights. When the fish are accompanied by thin strips of blue tissue hanging from the lights, your classroom will look like an underwater river scene.

Extended activities:

1. Have students make mobiles of different species of fish found in the Columbia River system.

2. Have students make a bulletin board showing reasons for the decline in the salmon population in the Columbia-Snake system and ways we are trying to increase the fish population.

SALMON OF THE COLUMBIA RIVER

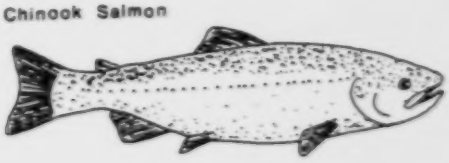
Coho Salmon

The coho salmon, also known as silver, is smaller than the chinook, averaging about eight pounds. It is metallic blue along the back, fading to silver on the sides and belly. Often confused with chinook, silver salmon are distinguished by the absence of black spotting on the dorsal fin and the lower lobe of the tail. Coho are three years old at maturity.

Sockeye Salmon

The sockeye salmon, also known as blueback and kokanee, is the smallest salmon, weighing up to four pounds. Its back is green-blue, and it has silver sides and belly. It has no black spotting. Columbia River sockeye are normally four years old at maturity.

Chinook Salmon



The chinook salmon, also known as king, spring, and tyee, is recognized as king of salmon. A robust, deep-bodied fish with lengths up to nearly five feet, he is a favorite catch of fishermen. Weights range from 10 to 45 pounds. Chinook are normally four years old at maturity, but may range from three to seven years old. The chinook's back is greenish, fading to silver on the sides and belly. Profuse black spotting appears on the back dorsal fin and both lobes of the tail. As with all Pacific salmon, spawning fish turn darker.

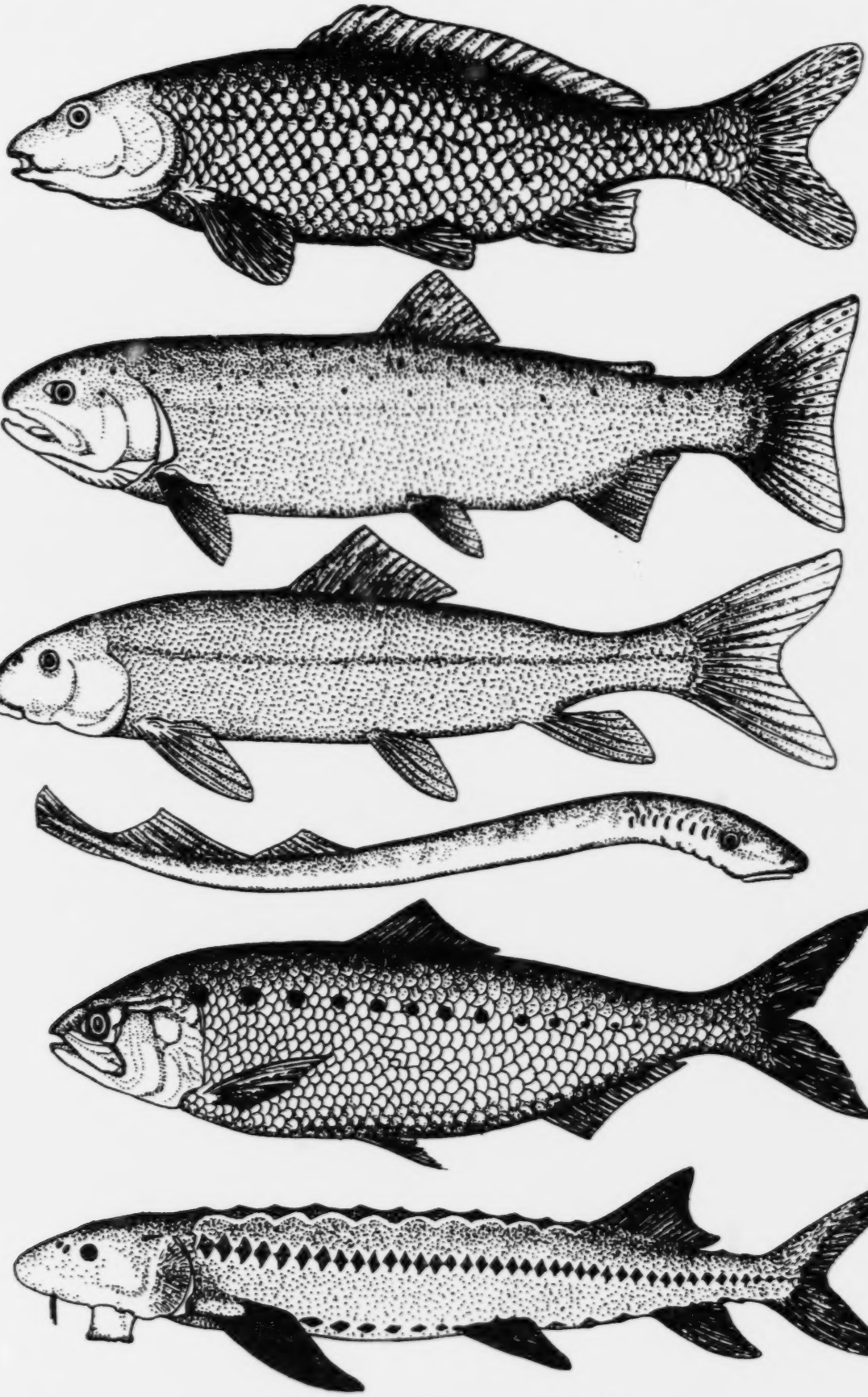
Steelhead Trout

Steelhead are rainbow trout that, like salmon, migrate to the ocean and then return. They migrate to sea during their first or second year and return to the rivers two to three years later. Oregon steelhead may be found returning from the ocean on their spawning runs almost any time of the year. After they enter the rivers, they take on the characteristic rainbow coloration.

Chum Salmon

Chum salmon is second in size only to the chinook. Chum average about 10 pounds but have been recorded up to 33 pounds. This species of salmon is not very abundant in Oregon. It occurs mostly in Tillamook streams. It is not as popular a sport fish as other species of salmon.

FISH OF THE COLUMBIA RIVER



Activity: Diorama--Salmon Harvesting Techniques

Concepts:

1. Salmon fishing in the Columbia River system began with primitive fishing methods.
2. New technologies were used to catch more fish.
3. Dipnetting, gillnetting, horse seining, fish wheels, trolling, and hook-and-line have been used to fish the Columbia.
4. So that salmon will be protected, fishermen are now forbidden to use more efficient methods of harvesting them.

Objectives: The students will be able to

1. tell how fishing for salmon in the Columbia River changed over the years.
2. describe in detail different ways to catch salmon.
3. define "salmon harvesting."

Teacher prep:

1. Duplicate class set of the student reading selection.
2. Gather necessary materials.

Materials:

1. shoe box or small box of similar size for each student or student pair
2. tooth picks
3. string
4. construction paper
5. modeling clay
6. glue
7. scissors
8. any other art materials available
9. 5" x 8" index cards
10. photographs of different fishing techniques, if available

Procedures:

1. Read the student reading selection with the class. Discuss with students the illustrations of the harvesting techniques. Show students photographs of different harvesting techniques. Ask students to explain how each technique works.

2. Divide the class into student pairs or have students work individually. Ask students to choose one of the techniques discussed (or you may assign the techniques so that each is covered). Distribute boxes and have students make a diorama illustrating their harvesting technique. Remind students to use a variety of materials in the diorama. Encourage students to make the diorama as detailed as possible, showing the people who fished that way and where they fished. Have students be sure to pay attention to the background of their diorama.

3. Give each student or student pair an index card. Have students write a brief description of the harvesting technique they presented in their diorama. Attach the descriptions to the diorama.

4. Give students an opportunity to share their finished dioramas with the class. Put the dioramas on display in the classroom, in the school showcase, or in the school library.

Extended activities:

1. Have students paint a mural for classroom display, showing the various harvesting techniques.

2. Ask students to make a time chart showing when various harvesting techniques were used, when new techniques were invented, and when techniques were outlawed.

3. Purchase salmon (fresh, frozen, smoked, or canned) for the class to taste. Brainstorm different ways salmon can be eaten. How has salmon been prepared in meals eaten by your students?

Salmon Harvesting: A Reading

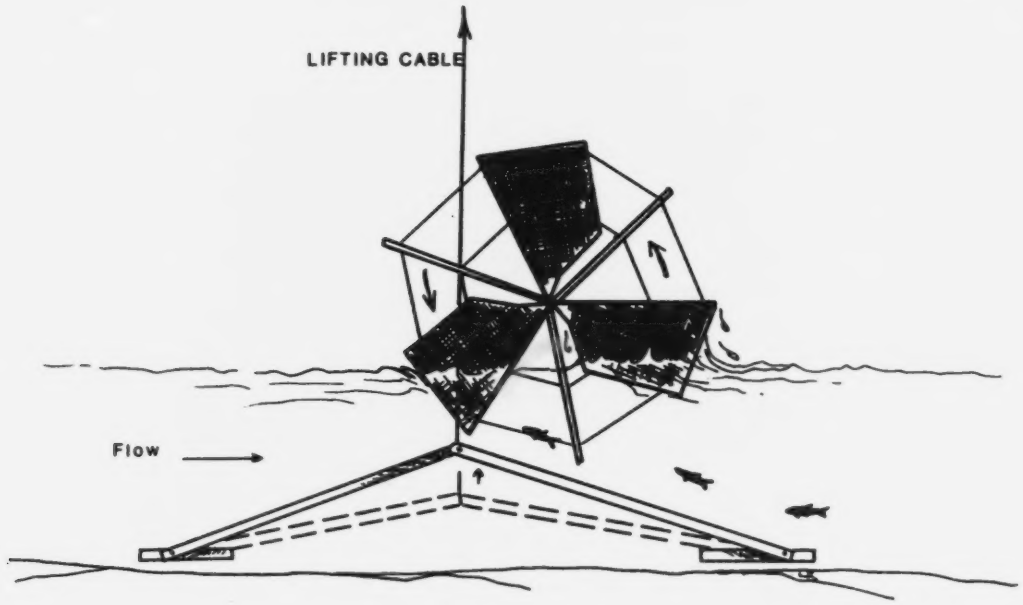
How can you catch a salmon? Salmon have been caught, or harvested, in many different ways.

Long ago the Indians used nets and spears to catch salmon. Some Indians built small wooden platforms over the river. They would stand on these platforms, stretch out, and drop dip nets into the river below. About 18 million pounds of salmon and steelhead were harvested from the river each year.

DIPNETTING ON THE COLUMBIA

Then white settlers began to fish for salmon. Gill nets, fish wheels and horse seines were used to catch salmon.

Fish wheels were water-powered machines which scooped salmon out of the river and dumped them into a box. They were placed in swift water in the path of migrating salmon. Samuel Wilson built the first fish wheel on the Columbia in 1879. By 1899, there were 76 fish wheels. A good fish wheel could catch about 100,000 pounds of salmon in a year. In 1913, one fish wheel caught 70,000 pounds of salmon in one day. Fish wheels were outlawed in Oregon in 1926 and in Washington in 1934.



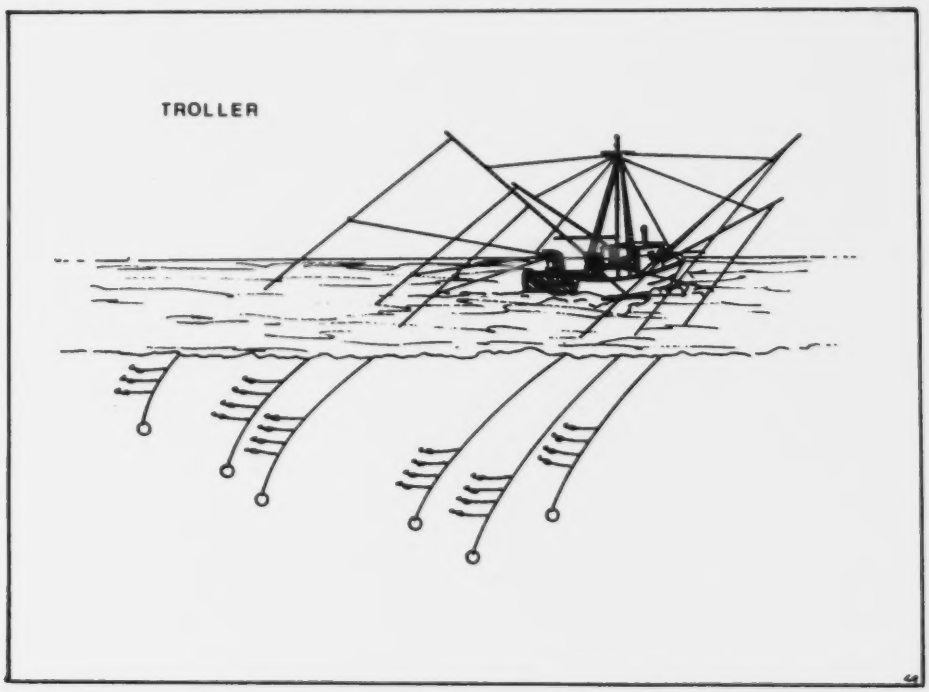
Inclined Fish Wheel

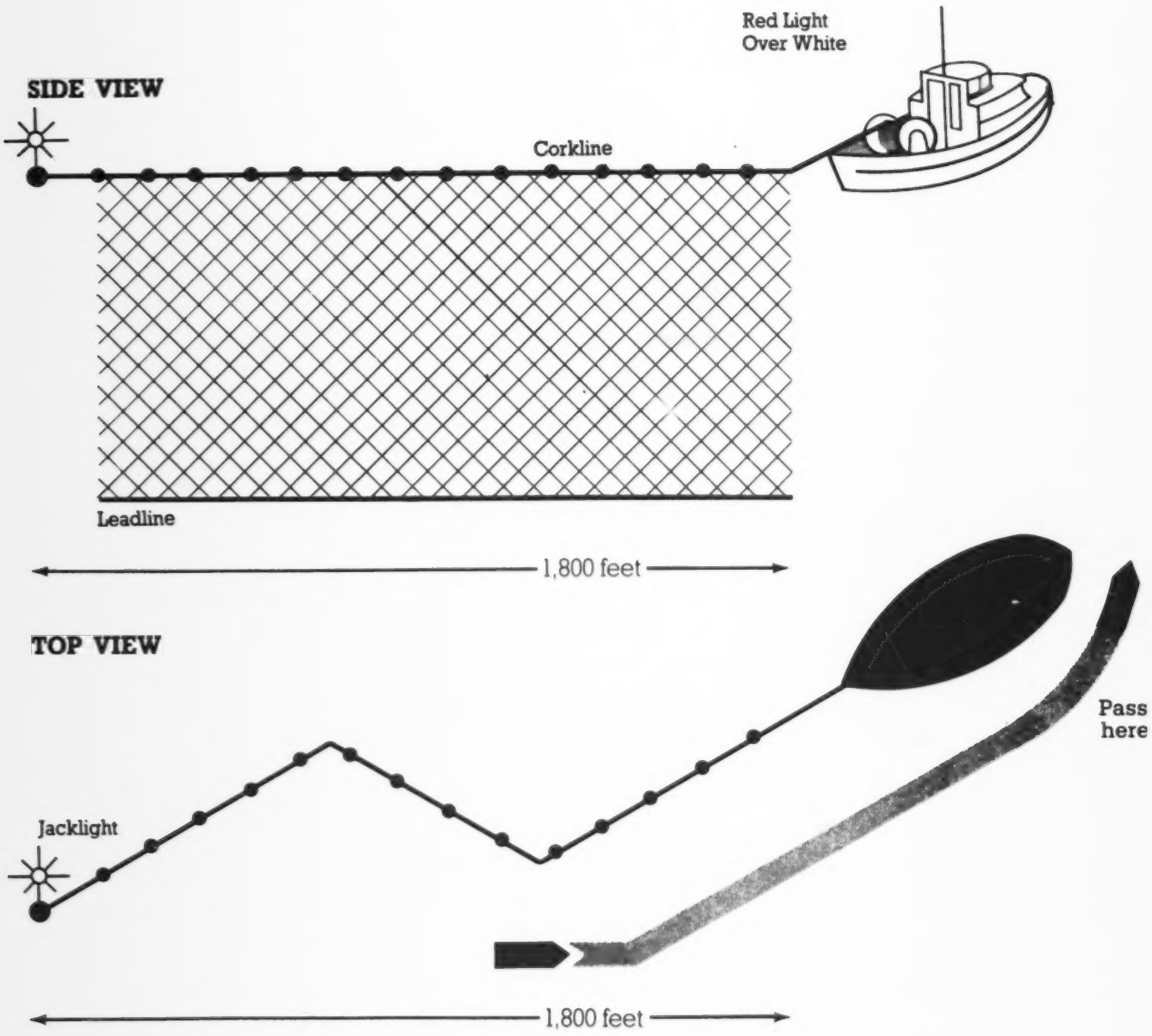
Horse seining was another way used to catch salmon. Fishermen put seines, special types of nets, in the river. Horses were used to pull the seines closed, trapping salmon inside. The horses pulled the seines to shore where the salmon were taken from the nets. One fisherman using horse seining caught 60,000 pounds of fish in one day in 1921. You can see this method worked very well. It was outlawed in the 1950s.

Traps were also used to harvest salmon. Gill nets, which get the salmon tangled up to catch them, were used. Trolling and hook-and-line fishing were also used to catch salmon.

Today gillnetting, sportfishing, and Indian dipnetting are the only legal ways to harvest salmon.

Horse Seining





Floating Gillnet

Activity: Career Ed/Create a Game

Concepts:
1. Salmon and steelhead are anadromous fish.
2. Anadromous fish face many dangers in their life cycle.
3. Only 1 percent of the salmon hatched in the Columbia-Snake system survive all of the dangers faced and return to spawn successfully.

Objectives: The students will be able to
1. define "anadromous."
2. define "spawning."
3. briefly describe the work done by a fisheries biologist.
4. create a game detailing the life cycle of a salmon.

Teacher prep:
1. Make an overhead transparency of the student reading material or duplicate student copies.
2. Gather necessary materials.
3. Put together spinner and markers for Splash game.*

Materials:
1. student copies of reading material or an overhead transparency
2. Splash game
3. tagboard sheets or heavy construction paper
4. felt markers
5. rulers
6. small construction paper squares or 3 x 5 index cards
7. laminating paper and laminator (optional)

Procedures:

1. Distribute student reading selection. Explain that this is a letter written to a middle school student by a fisheries biologist who works on the Columbia River system. Have students read the letter. Ask students: What does a fisheries biologist do? What questions was the biologist answering in his letter? What are smolts? How can you use scales to tell the age of a fish?

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*At the end of this section is a much-reduced copy of Splash. To obtain a full-size copy (17" x 22") of the game, write the U.S. Army Corps of Engineers, North Pacific District, Public Affairs Office, P.O. Box 2780, Portland, OR 97208.

2. Show students the Splash game. Select four students to play the game in front of the class. (Put the game board on a bulletin board and pin the markers in place as they are moved around the board. The game goes very quickly and should hold the class' attention.) Review with the class the dangers faced by salmon during their life cycle. What dangers are shown on the Splash game board?

3. Ask students to create their own game, complete with game board, markers, and rules, which shows the life cycle of an anadromous fish. Supply the students with the necessary materials to do so. Encourage students to illustrate their gameboards with scenes from the life of an anadromous fish. Encourage advanced students to include "chance" cards (as in Monopoly) which must be drawn and followed upon landing on special spaces.

4. When the games are completed, have students share their games orally in front of the class. Set aside time for students to play each other's games. You might choose six or seven games to highlight each day, set them out in stations around the classroom, divide the class into six or seven groups, and have the groups rotate from game station to game station as you keep track of the time. (Laminating finished game boards helps them last longer for classroom use.)

Extended activities:

1. Have students write to a fish hatchery found in the Columbia River system. Have them address the letter to the attention of a fisheries biologist. In the letter students could ask any questions they have about fish found in the Columbia or about current research projects.

2. Have students create a game which depicts the life of a fisheries biologist. It could include required schooling, the perils of federal funding, the tasks performed at work, and the controversy of setting fishing seasons and limits.

3. Have students read the article "Fish Show Their Age." Obtain a fish with large scales. Have interested students attempt to find the age of the fish.

4. Have students research the differences among chum salmon, chinook salmon, and sockeye salmon. Have them report their findings to the class.

Dear Corey:

Thanks for the nice letter. Sounds like you are busy at school. Being a fisheries biologist at Grand Coulee keeps me busy, too.

This week was a very busy one. I spent the first part of the week working with the computer. We store information in the computer about how many fish are caught, what kind of fish are caught, how much the fish caught weigh, the length of fish caught, the age of fish caught, and where different kinds of fish are caught. I used the information kept in the computer to help me write my yearly report. The report goes to people in our government and to other groups who make decisions about the fish in the Columbia system. They decide things like how many fish can be caught, where people can go fishing, and how much water is needed in the river for the fish.

After I finished my report, I got to go out on the lake and leave my office work behind. On Friday I pulled fish out of gillnets for our regular sampling. We try to estimate how many walleyed pike and other fish are found here. Sunday I interviewed fishermen, or anglers, as we fisheries biologists call them, to see how many fish they were catching and where they were catching them. Interviewing two deaf anglers was my biggest challenge. I also measured fish and took scale samples to see how old the fish were.

Now let me answer the questions you asked in your letter.

1. Spawning takes place when adult female salmon lay their eggs in the gravel of stream bottoms and male adult salmon fertilize the eggs with milt.

   Young salmon hatch in two to four months. They stay in the gravel for about 30 more days. They live on materials in the yolk sac that is attached to their

stomach. When the yolk sac has been used up, the "fry," as the fish are called at that point, leave the gravel and start to feed. Some swim to the ocean right away. Other salmon stay in fresh water a year or more before they head to the ocean. The salmon grow up in the ocean. When they are full grown, two to seven years old, the salmon return to the fresh water to spawn. They swim to their "cradle stream" where they were hatched.

After spawning, the Pacific salmon die. Their eggs hatch and the cycle repeats.

2. Anadromous fish hatch in fresh water, live part of their lives in the ocean, and swim up rivers and streams to spawn.

3. The life cycle of each type of salmon is a little different. The salmon differ in where they spawn, the time they spend in the Columbia River system, the time they spend in the ocean, the water temperature they seek and at which they spawn, and where they are found in the ocean.

It's time for me to go work. Today I am going to a meeting to talk about ways to help young salmon get past the dams to reach the ocean safely. Smolts have been put on barges or trucks and moved closer to the mouth of the Columbia. We'll talk about how that has worked. It should be an interesting meeting.

Thanks again for your letter and questions about the fish of the Columbia system. I'm glad you are studying about fisheries and are thinking about the hard decisions of how best to use the water of our great river.

Sincerely,

Riley Willard

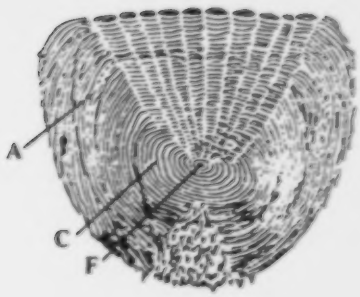
Fish Show Their Age

Determining the age of fish is an important part of fisheries management. Knowing how old fish are in a population helps biologists determine how well the population is doing. Examining fish scales is one way to find out how old fish are.

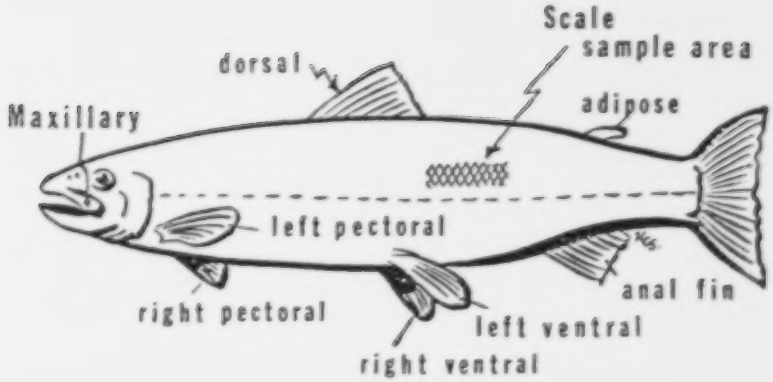
Most fish are born without scales, however, before long the scales form. As the fish grows, the scales increase in size while the number of scales remains about the same. Growth begins at the fins near the center of the scale. As growth proceeds, fine ridges called circuli are laid down in a circular pattern around the focus. The circuli are widely spaced when food is plentiful and growth is rapid, and closely spaced when food is scarce and growth is slow. One year's growth is usually revealed as a series of widely spaced spring and summer circuli followed by a series of closely spaced fall and winter circuli. The pattern is repeated each year, however, in temperate regions such as Oregon's Willamette Valley and coastal area, this pattern may not always follow the seasons so closely. The outer edge of a series of closely spaced circuli, called the annulus, represents the end of growth for that year. The age of the fish is determined by counting the number of annuli (plural for annulus). Often the circuli are so close together they form dark rings that can be easily counted.

With the aid of a good hand lens, fish with large scales such as carp or bass can be aged as you catch them. Remove some scales from the fish using tweezers (or your fingers). A good place to get well-developed scales is just above the lateral line and below the dorsal fin. When examining the scale, it works best to place it on a flat glass slide or piece of clear or colored plastic. Any flat surface will work if the light is right; you can adjust for light conditions.

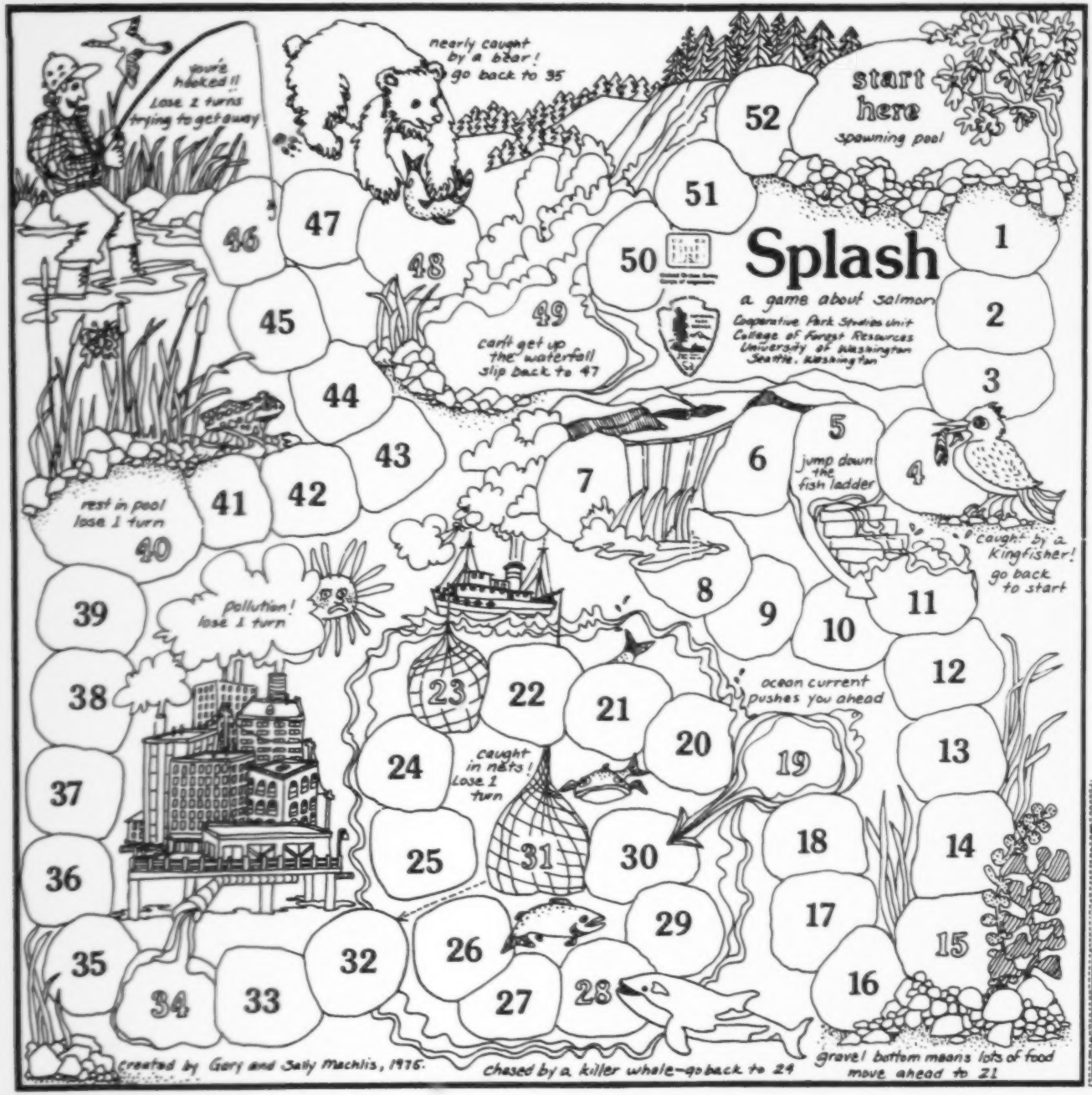
Examine the scale with the hand lens, using the drawing as a guide. Look for the closely-spaced circuli, sometimes so close together that it appears they do not reach all the way around the scale, to identify the annuli.

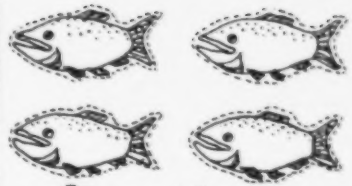


Typical fish scale.
A-annulus, C-circuil, F-focus



From Oregon Wildlife


Splash
a game about salmon
Cooperative Park Studies Unit
College of Forest Resources
University of Washington
Seattle, Washington
start here
spawning pool
you're hooked!! Lose 2 turns trying to get away
nearly caught by a bear! go back to 35
can't get up the waterfall slip back to 47
jump down the fish ladder
caught by a kingfisher! go back to start
rest in pool lose 1 turn
pollution! lose 1 turn
ocean current pushes you ahead
caught in nets! Lose 1 turn
chased by a killer whale—go back to 24
gravel bottom means lots of food move ahead to 21
created by Gary and Sally Machlis, 1976.



directions

1. cut out the spinner and tape it to a piece of thick cardboard.
2. cut out the arrow and stick a pin through the dot on the arrow and into the spinner.
3. Cut out and color the fish markers and tape a penny to the back of each one.

youre ready to play!!

rules

1. the object of the game is to be the first player to return to the spawning pool.
2. each player takes his/her turn by spinning the arrow and moving ahead the number of spaces the arrow points to.
3. if you land on a number that looks like this **2** rather than this **2**, you must follow the special directions on the board.

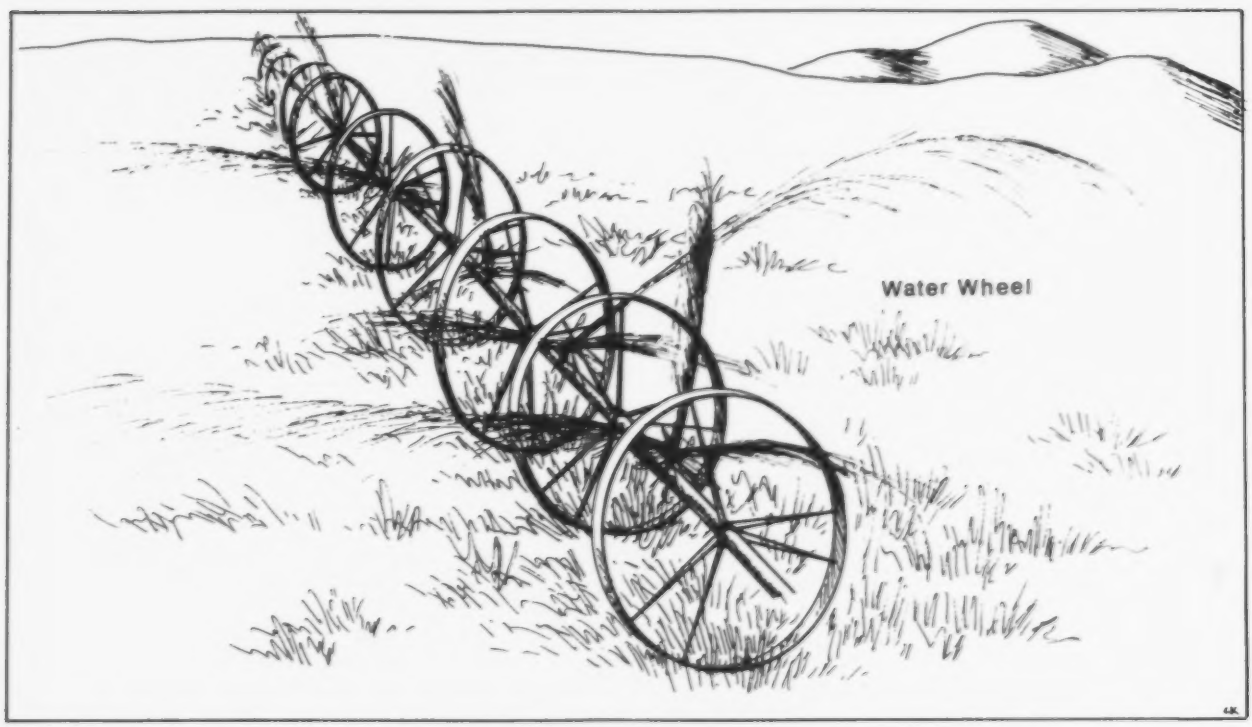
Agriculture

Agriculture: A Reading

If you were a farmer who wanted to raise crops or livestock on dry land, what would you do? Imagine that you have good soil and good weather and that your land is near a great river system. How could you make things grow?

Farmers and ranchers in the Columbia River area, faced with this problem, irrigate their land. To irrigate means to supply land with water by means of channels, pipes, ditches, or sprinklers. The river's water is sometimes called "liquid gold" because it helps change dry land into valuable farm land.

In the 1830s, the first farmers in this area began to irrigate their lands. They did this by diverting water from nearby streams. Diverting means to take water away from where it usually flows. As time went on, farmers joined together to pay for bigger and better irrigation systems. Then dams were built on the river. The dams made storage reservoirs for water and also produced cheap electricity which could be used to pump water to where the farmers and ranchers needed it.

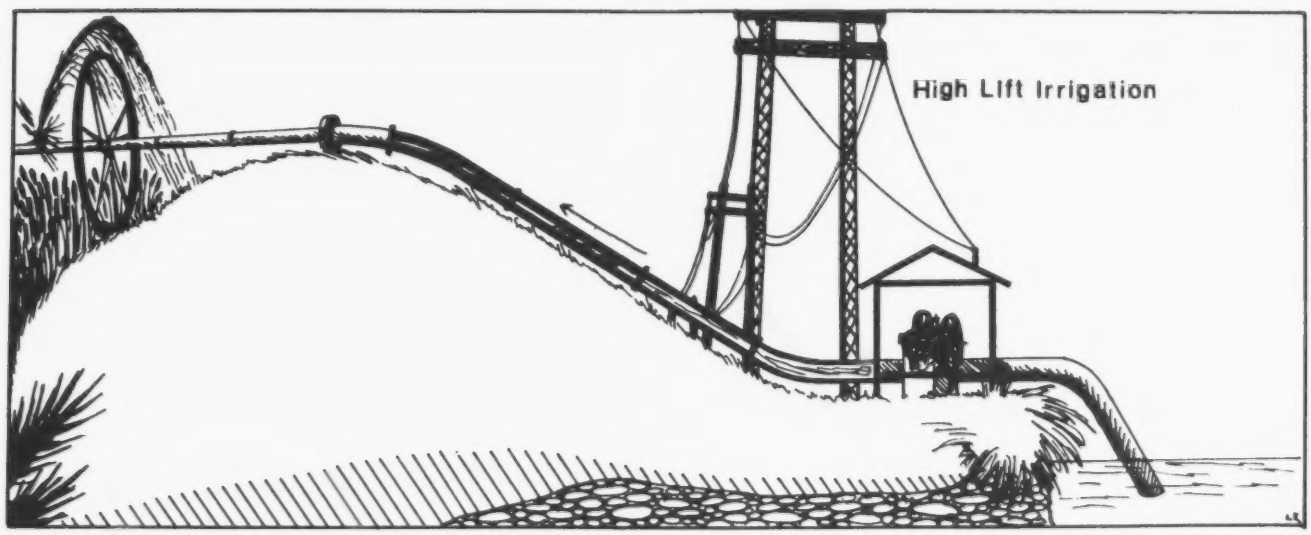


Today, many crops are produced by irrigation in the Columbia River area. Currently grown are wheat, alfalfa, onions, plums, seed crops, mint, peas, dry beans, melons, apples, pears, potatoes, hops, cherries, and wine grapes. Cattle and sheep are raised in this area. Dairy farming is important, too.

About 8 million acres of land are irrigated in the Columbia River area. Products grown on irrigated land are worth about $3 billion a year. That means agriculture--the science and work of growing crops and raising livestock--is an important part of the Pacific Northwest's economy.

New irrigation systems, such as the circle sprinkler system, and modern high-lift pumping methods, have been developed to grow crops. However, even with these new irrigation methods, farmers and ranchers want more water from the river to irrigate more land.

Irrigation takes water from the Columbia River system, uses it to help plants grow, and returns very little of that water to the river system. The water goes into the plants or evaporates or goes down through sandy soil away from the river. The water that does return to the river system sometimes carries chemicals such as pesticides, herbicides, and fertilizers used in farming.



So, there are good things and bad things to think about when you think about irrigation. It does help farmers and ranchers grow many agricultural products. These products are worth a great deal of money. These products help feed hungry people. But irrigation takes water from the river system. It changes the flow, volume, and quality of the water. These changes affect fish, wildlife, navigation, recreation, and hydropower production. Irrigating land can also use a great deal of energy.

Activity: Columbia River Feast

Concepts:
1. The Columbia River is used to irrigate approximately 8 million acres of farmland.
2. A variety of crops are produced by irrigation.
3. Much of the water diverted for irrigation does not re-enter the river.

Objectives: The students will be able to
1. name several crops produced by irrigation in the Columbia River area.
2. prepare an edible dish from Columbia River crops.
3. define "irrigation."
4. define "agriculture."

Teacher prep:
1. Gather necessary materials, including ingredients and cooking utensils.
2. Make an overhead transparency of the recipes.
3. Duplicate class set of the student reading selection.

Materials:
1. class set of student reading selection
2. ingredients and utensils as required for each recipe
3. tagboard or construction paper
4. lined paper
5. yarn
6. hole punch

Procedures:

1. Ask student volunteers to orally define "agriculture." Ask students what crops might be grown in the Columbia River area. Ask students to define "irrigation." Ask students to describe orally any examples of irrigation they may have seen. Suggest the use of sprinklers on the school lawn, if your students cannot think of any irrigation they have seen.

2. Have students read the "Agriculture and Irrigation" selection.

3. Then write "apples" on the board. Ask students to name all the ways to eat apples they can. Do the same for wheat, lentils, pears, and corn. Prepare the following (easy and delicious) dishes with your class. Time, budget, and equipment restrictions may determine what dishes to make with your students. You may have favorite recipes of your own featuring crops from the Columbia region.

4. Make a transparency of the recipes chosen. Have students copy the recipes. Give them lined paper on which to copy the recipes. A sheet 8½" x 11" cut in half horizontally works well.

5. If you make more than one dish, have students put the recipes together into a Columbia River cookbook. Give students construction paper or tagboard for covers (again, cut 8½ x 11 sheets in half). Punch two holes in the left edge of the recipe booklet. Have students string yarn through the holes to hold the cookbook together. Encourage them to decorate the cover with Columbia River scenes.

6. Invite parents to come sample the class' favorite Columbia River recipes on a Columbia River Day. Students could share their favorite dishes, show work completed earlier in the unit, such as dioramas and mobiles, present their legend puppet shows, or recite poems about the Columbia River.

Extended activities:

1. Have students bring in recipes which use Columbia River area agricultural products. Display the recipes on a bulletin board or duplicate the recipes to send home with classmates.

2. Encourage interested students to try out at home recipes using agricultural products from the Columbia River area and to bring in samples for the class.

3. Have students inventory their kitchen at home, looking for all the agricultural products which could have come from the Columbia River area.

4. Have students check through the school's monthly hot lunch menu to see what dishes are served which contain agricultural products grown in the Columbia River area.

5. Have interested students interview the school's cook or food purchaser to see what Columbia River agricultural products are used by your school.

6. Give interested students an opportunity to research different types of irrigation systems. Have them make models of different types for display in the classroom.

Forlorn Lakes Salad

For each salad:

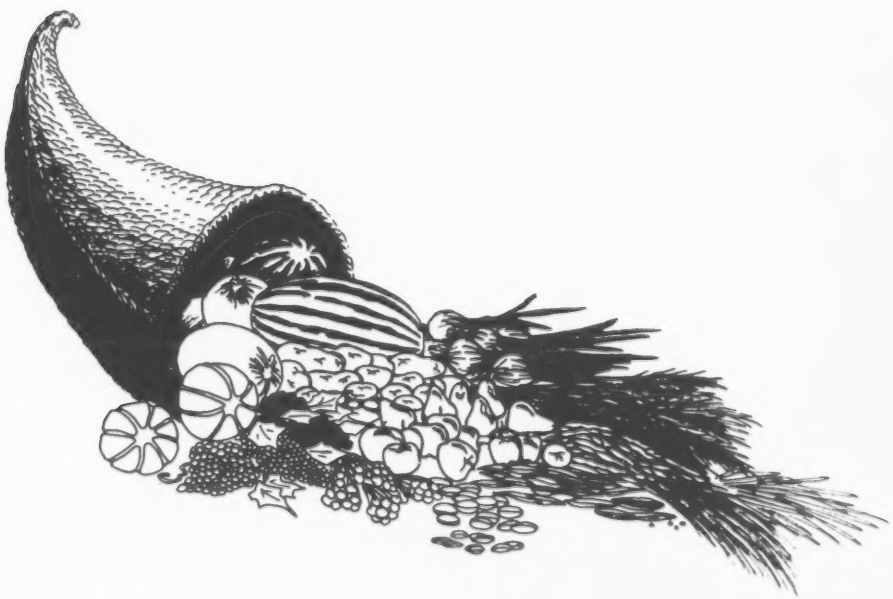
Utensils	Ingredients
paper towels	1 lettuce leaf
salad plate	1 pear half
fork	1 raisin
kitchen scissors or knife	1 maraschino cherry
teaspoon	2 canned mandarin orange segments

Wash 1 lettuce leaf and pat dry with paper towel. Place on salad plate.

Place the pear half, cut side down, on the lettuce leaf. Place the orange segments at the small end of the pear half for a fish tail.

Scoop out a tiny hole in the pear half for the eye. Place 1 raisin in the hole. Cut the maraschino cherry into quarters.

Scoop out a little hole in the pear half for the pectoral (side) fin. Place a maraschino quarter in the hole. Place the other maraschino quarter at the top of the pear half for a dorsal (middle of the back) fin.



Washington Apple Candy

For 4 dozen squares:

Utensils	Ingredients
saucepan	2½ cups applesauce
paper towel	4 envelopes unflavored gelatin
wooden spoon	4 cups sugar
knife	1 tsp. vanilla
baking pan	1 cup chopped nuts
	powdered sugar
	butter

Combine 1 cup applesauce and gelatin. Add 1½ cups applesauce to sugar. Combine with gelatin mixture. Cook 15 minutes over medium high heat. Remove from heat and add vanilla and nuts. Pour into a buttered pan. Cool. Cut into squares. Roll the squares in powdered sugar.

Hood River Apple Fritters

Makes 3 dozen

Utensils	Ingredients
paper towels	1 1/3 cups sifted enriched flour
slotted spoon	1 tablespoon sugar
deep fryer or electric fry pan	2 tsp. baking powder
	½ tsp. salt
	2 beaten eggs
	2/3 cup milk
	1 tablespoon salad oil or melted shortening
	3 cups small strips of apple*

Sift dry ingredients together. Blend eggs, milk, and salad oil; add dry ingredients all at once and mix just till moistened. Stir in apple strips. Drop from tablespoon into deep, hot fat (375°). Fry till puffy and golden, 39 to 4 minutes; turn once.

Drain on paper towels. While warm, sprinkle with confectioners' sugar and serve at once. Makes about 3 dozen.

Note: To keep first fritters hot while you fry remaining batter, place them in a very slow oven (250°) for a short time.

*Pare and core 3 or 4 tart, medium apples; cut crosswise in 1/8 inch slices. Stack several slices and cut in 1/8 inch strips.

Alfalfa Sprout Salad

Makes 8 large servings

Utensils

knife
mixing bowl
sauce pan
jar

Ingredients

4 cups alfalfa sprouts
2 medium tomatoes
½ cup sliced green onion
½ cup snipped parsley
4 tablespoons chopped green pepper
Garlic Dressing
2 cups cubed cheddar cheese

Cook sprouts, uncovered, in small amount of boiling water for 3 minutes; drain and cool. Peel and chop the tomato. In mixing bowl combine sprouts, tomato, onion, parsley, and green pepper. Pour Garlic Dressing over sprouts mixture and toss gently to coat. Cover and chill 30 minutes. Add cheese, and mix lightly. Serve in lettuce cups, if desired.

Garlic Dressing: In screw-top jar combine 3 tablespoons salad oil, 2 tablespoons wine vinegar, 1/8 tsp. garlic salt, and a dash of freshly ground pepper. Cover; shake well.

Whole Wheat Quick Bread

1 loaf of 15 thick slices

Ingredients

2 cups whole wheat flour
1 tsp. baking soda
2 tsp. baking powder
1 tsp. salt
½ cup soy flour
6 tbsp. corn oil
1½ cups sour milk (or 1½ cups milk with 2 tsp. vinegar)
⅓ cup molasses (or honey, if you prefer)
¼ cup wheat germ
¼ cup instant dry milk

Preheat oven to 350°. Put ingredients in a bowl. Stir well. Spoon into buttered 9-x 5-inch loaf pan. Let stand for 20 minutes. Bake for about 35 minutes, or until the bread is nicely browned and tests dry with a toothpick.

A lovely bread, especially for breakfast.

Utensils

bowl
9- x 5-inch loaf pan
fork

Sprout Gardening in a Jar

You can easily set up a sprout garden in the dark corner of a classroom shelf. All you need is a quart jar, cheesecloth, and alfalfa seeds. Wash and sort ½ cup of seeds, discarding damaged seeds. Soak seeds overnight in 2 cups water (seeds will swell to twice their size). Drain and rinse. Place ¼ cup of soaked seeds in each quart jar. Cover tops of jars with two layers of cheesecloth; fasten each with a rubber band or string. Place jars on their sides so seeds form a shallow layer. Store in a warm (68° to 75°), dark place. Rinse seeds once daily in

lukewarm water. Harvest sprouts in 3 to 5 days. You can eat the whole sprout: seed, root, stem, and outer hull. If you prefer to remove the hulls, place sprouts in a bowl; cover with water and stir vigorously, skimming away husks as they rise to the top. Drain. Pat dry with paper toweling. Sprinkle sprouts over tossed salads or use to make Alfalfa Sprout Salad.

Columbia Basin Lentil Soup

In a large pot saute 3 to 5 min:

- ¼ cup olive oil
- 2 large onions, chopped
- 1 carrot, chopped

Add and saute 1 min more:

- ½ tsp. each dried thyme and marjoram leaves

Add:

- 3 cups stock or seasoned water
- 1 cup dry lentils, washed
- salt to taste
- ¼ cup chopped fresh parsley
- 1 lb. canned tomatoes

Cook in covered pot until lentils are tender (about 45 min).

Have ready: 2/3 cup grated Swiss cheese

To serve, place 2 tbsp. of grated cheese in each serving bowl and top with soup. This soup is especially delicious served with corn muffins. Fresh or stewed fruit is a just-right finish for the meal if the sweet tooth needs pleasing.

<u>Utensils</u>

knife

large sauce pan

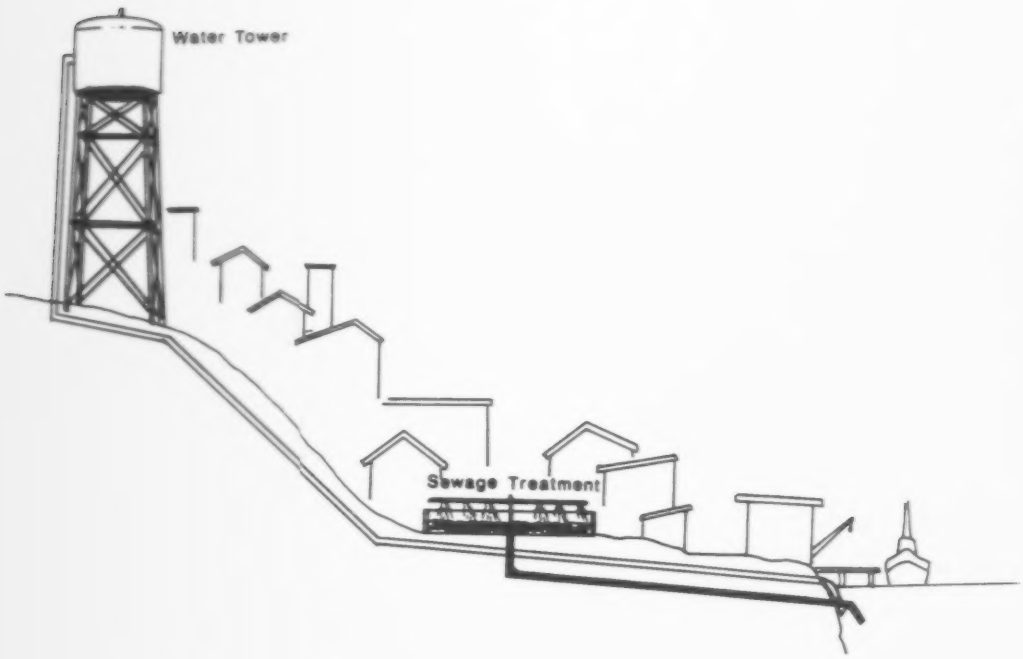
Recreation

Recreation, Water Supply, and Waste Disposal: A Reading

We often take our water recreational activities for granted. We also often forget that the Columbia River is used for domestic, industrial, and municipal use.

All these uses of the river are important. They also have one thing in common--they all need access to a clean water source. We know we need to have clean, safe water to drink and bathe in. We know too that we need safe, clean water for swimming, fishing, sailing, and so on.

But did you know that we often use the river to dispose of the many wastes that our society generates and accumulates? Many municipal, industrial, and agricultural waste treatment facilities are located along the Columbia River. They need clean water to operate efficiently. They take the water and use it in their waste treatment processes. After the majority of pollutants are removed, the water is returned to the river. The river helps to further dilute these wastes.



In some instances, the river is used for cooling purposes. Some nuclear and coal-powered electrical generating plants use the water to generate steam to turn these generators and turbines. This heated water may then be returned to the river, where the heat is diluted.

These uses of the river are neither glamorous nor well known, but they are important. They also are closely monitored. Overuse in this area could result in water pollution problems which could affect the other users of the river. Here, too, a balancing of the uses of the river must be considered.

Activity: Brainstorming/Graphing Waterfalls*

Concepts:
1. The Columbia River gorge is one of the most beautiful areas in the country.
2. Many tourists visit the gorge and enjoy its beauty.
3. More than 20 waterfalls contribute to the beauty of the gorge.

Objectives: The students will
1. understand that tourists visit the gorge to enjoy the beauty of the waterfalls.
2. construct a bar graph of the heights of the major falls of the gorge.

Teacher prep:
1. Gather necessary materials.
2. Read teacher information sheet.

Materials:
1. student data sheets of the major waterfalls of the gorge and their respective heights
2. graph paper
3. colored pencils
4. scratch paper and pencils
5. slide projector

Procedures:

1. Tell students that more than 20 waterfalls can be found in the Columbia River gorge. Ask students why so many waterfalls would be found in this area. List their suggestions on the board. Review with students, through class discussion, how the Columbia River gorge was formed.

2. Show students slides of the major waterfalls.** Instruct students to take out pencil and paper and to put the pencil down. Ask students to close their eyes and think of all the words that come to mind to describe the waterfalls of the Columbia River gorge. Give the students 15 seconds of silence to do so. Then tell the students that when you say "Go," they are to write down all the words they can think of that describe the waterfalls. Tell the students they will have 60 seconds to do their writing. Have students share their lists with the class. Remind students during this sharing that the beauty of the waterfalls is one reason tourists visit the gorge.

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*This lesson plan focuses on major waterfalls; however, teachers may want to study waterfalls that are closer to their school.

**A set of five slides can be ordered for $2.00 from
Smith Weston, Inc.
1133 N.W. Glison
Portland, OR 97209

3. Distribute a sheet listing major waterfalls and their heights. Go over pronunciation of waterfall names. Review the construction of a bar graph. Distribute graph paper and ask students to graph the heights of the major waterfalls of the Columbia River gorge.

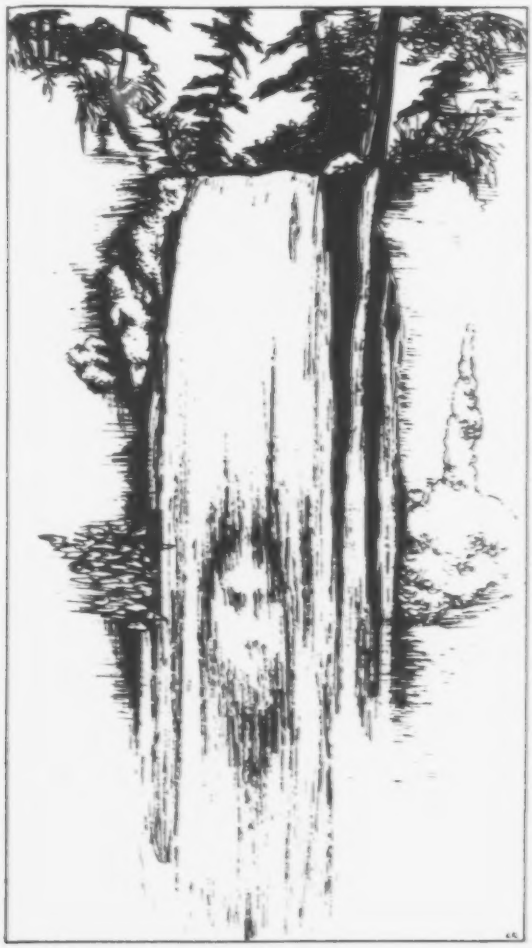
4. When the graphs are finished, ask students:
   Which waterfall is the highest?
   Which is the lowest?
   What is the difference between the highest and lowest?

5. Display the graphs on a bulletin board.

Extended activities:

1. Have interested students guess the origin of the names of the major waterfalls. Then have students investigate to find out where the names really came from. Have the students share their information with the class.

2. Have students make a display, matching drawings of Multnomah Falls with their version of the Indian legend explaining the falls.



Waterfalls of the Columbia River Gorge

There are more than 20 waterfalls in the Gorge area. The following are some of the major ones and their respective heights:

Horsetail Falls	221 ft.
Elowah Falls (McCord Creek)	289 ft.
Multnomah (fourth highest in U.S.)	620 ft.
Upper 542 ft. - Lower 69 ft.	
Wahkeena Falls	242 ft.
Starvation Creek Falls	186 ft.
Latourell Falls	249 ft.

Activity: Reading a Chart/Designing a Park

Concepts:

1. Recreation is an important use of the Columia River system.
2. Many recreational activities are available in the Columbia River area.
3. These activities require a clean, safe, natural environment.
4. Most of these activities are water related.

Objectives: The students will be able to

1. name several recreational activities which can be enjoyed in the Columbia River area.
2. define "recreation."
3. read a chart to find what facilities are available at different parks.
4. design a park with recreational facilities.
5. tell how different river uses might be in conflict.

Teacher prep:

1. Make student copies of the reading selection.
2. Make an overhead transparency and student copies of the chart.
3. Gather necessary materials.

Materials:

1. student reading selection
2. parks chart
3. butcher paper
4. felt pens or colored pencils

Procedures:

1. Ask students what they enjoy doing when they go on vacation. List responses on the board. Distribute the student reading selection. Have students read the selection orally. Go over the list on the board. What activities listed there could be done in the Columbia River area? Discuss the last section of the reading selection. Ask students to think of other ways in which different uses of the Columbia might cause problems for recreation.

2. Distribute parks chart. Make sure the students understand the terms "facilities," "concession," "sanitation facilities," and "boat moorage." Ask students the following questions:
   How many parks have places for trailers with hookup?
   Which parks have places you can go picnicking?
   Which parks have places for fishing?
   Would you have to pay money to use Biggs Park?
   Could you camp overnight at Lepage Park?
   If you liked to waterski, what parks might you visit?

Could you swim at Cliff Area?
Which park has the fewest facilities?
Which park has the most facilities?
What is special about Philippi Park?
Which park would you like to visit? Why?
How many parks have a concession? What do you think they sell?

3. Ask students to think about what facilities they would use if they visited a park. Distribute butcher paper. Ask students to draw a map of their own park, complete with all the facilities they would enjoy using. The park should be located on the Columbia River. The drawing should show the park from the air. You might want to draw an example on the board so the idea of an aerial view is clear to the class. Ask students to name their park.

4. When the maps are completed, give students an opportunity to share them with the class. Then make a parks chart similar to the one used earlier in this activity but listing the student-designed parks. As the park maps are shared, ask students to point out the water-related activities.

Recreation:

What do you like to do when you go on vacation? Do you like to go sailing? Power boating? Water skiing? Fishing?

You can do all those activities and many more if you visit the Columbia River system.

You can go sight-seeing. Places like Maryhill Museum of Fine Arts and the Whitman Mission National Historical Site are fun to visit and interesting, too. You can visit fish hatcheries, such as the Spring Creek Fish Hatchery or Willard Fish Hatchery, and see how fish are raised and released into the Columbia.

Do you like to go on picnics? Do you like to go camping? There are many beautiful places, such as Oregon's Ainsworth State Park, where you can go along the Columbia system.

Have you ever been hiking? Oregon's John B. Yeon State Park and Washington's Beacon Rock State Park are two of many places with great hiking trails.

Do you like to ride your bicycle? In the Lewiston-Clarkston area bikeways connect a series of parks.

What makes the Columbia River area such a good place for recreation or free-time activities? Water does. All of the activities people enjoy in this area depend on a clean, safe, natural environment with plenty of water.

When we are deciding who gets how much of the water from the Columbia, we must remember all of the people having fun (and spending money) in recreational activities. They need water to go fishing, boating, swimming, and sailing. Hydropower dams can provide people with beautiful lakes for these activities. But dams can also destroy the river's fish. Irrigation can provide people with food to take on picnics. But irrigation can pollute the river or use up water from the river. Deciding what uses of the river are most important is very hard to do.

Extended activities:

Have students write for information on recreational activities. Students could write to the following agencies or to any town on the Columbia. Have students share with the class the materials they receive.

State Parks and Recreation Branch
State of Oregon
525 Trade Street, NE
Salem, OR 97310

State Parks and Recreation Commission
State of Washington
7150 Cleanwater Lane
Olympia, WA 98504

Department of Parks and Recreation
State of Idaho
Statehouse
Boise, ID 83707

Department of Fish and Wildlife
State of Oregon
1634 SE Alder
Portland, OR 97208

Department of Fisheries
State of Washington
115 General Administration Bldg.
Olympia, WA 98504

National Park Service
Public Information Office
Pacific Northwest Region
Fourth and Pike Building
Seattle, WA 98101

Parks Chart

*Access by boat only	Boat Launch Ramp	Picnicking	Fishing	Swimming	Water Skiing	Boat Moorage	Overnight Camping	Trailer/With Hookup	Trailer/No Hookup	Drinking Water	Sanitation Facilities	Concession	Fees Charged
Biggs Park	●	●	●								●		
Lepage Park	●	●	●	●	●	●	●		●	●	●		
*Philippi Park		●	●	●	●	●	●			●	●		
Arlington Park & Marina	●	●	●	●		●				●	●		
Quesnel Park	●	●	●	●	●		●		●		●		
Boardman Park	●	●	●	●	●		●	●		●	●		●
Irrigon Park	●	●	●	●	●	●				●	●		
Umatilla Park & Marina	●	●	●	●	●	●	●	●		●	●	●	●
Maryhill Park	●	●	●	●	●		●	●		●	●	●	●
Cliffs Area	●	●	●				●		●		●		
Railroad Island	●	●	●	●	●								
Rock Creek Park	●	●	●	●	●	●					●		
Sundale Park	●	●	●	●		●					●		
Roosevelt Park	●	●	●	●	●	●				●	●		
Alderdale		●	●										
Crow Butte Park	●	●	●	●	●	●	●	●		●	●		●
Plymouth Park	●	●	●	●		●	●	●		●	●		●

Activity: Waste Assimilation (Disposal)

Concepts:
1. Modern society generates many wastes which must be properly disposed of.
2. Water is often used to treat and dilute these wastes.
3. The Columbia River is used for waste assimilation by municipalities and by industrial and agricultural enterprises.

Objectives: The students will be able to
1. define what waste assimilation is.
2. discuss the concept and how and why it works.
3. state the benefits and costs of using the river for waste assimilation.

Teacher prep:
1. Make student copies of the reading selection.
2. Gather necessary materials.

Materials:
1. several empty milk cartons
2. glass containers
3. a water source: instant coffee

Procedure:

1. Distribute the reading selection. Have students read orally. Have students discuss the types of wastes that individuals, industries, agriculture, and cities generate. Ask students: How do we dispose of these wastes?

2. Fill two water glasses with water; fill the milk containers half full with water; put some instant coffee in the water glasses to color the water. Make sure you put equal amounts in each.

   Take one glass and pour its contents into a milk carton. Take the contents of the first milk carton and pour it into the second milk carton. Pour some of the contents of the second milk carton into an empty glass.

   Compare the color of the contents of this glass with the color of the contents of the first glass. What happened to the color? What did the water do to the coffee? Discuss how this process is used in your community to dilute your wastes.

Extended activities:

Ask students to find out if any nearby communities or industries are using the river for waste assimilation purposes. Have interested students contact the local municipal waste treatment operator. Perhaps you can invite the operator in to discuss the job and responsibilities.

Activity: Water Filtration

Concepts:
1. Water is needed for domestic, municipal, and industrial use.
2. Water needs to be of high quality for these uses.
3. Water often needs to be "purified" so that we can use it.

Objectives: The students will be able to
1. define what water filtration is.
2. discuss the concept and how it works.
3. state the benefits of using the river for our needs and why it is important that the water we use is of high quality.

Teacher prep:
1. Make students a copy of the reading selection.
2. Draw a diagram of the filtration column.
3. Gather materials; make the filtration column, or do it in a class.

Materials:
1. glass or plastic tube, at least one inch in diameter
2. funnel
3. water
4. rubber band
5. window screen (fine mesh)
6. charcoal granules, sand, fine gravel, coarse gravel
7. "dirt"
8. two glasses or containers

Procedure:

1. Distribute the reading selection. Discuss reasons why water needs to be "treated" for use in our homes, industries, and cities.

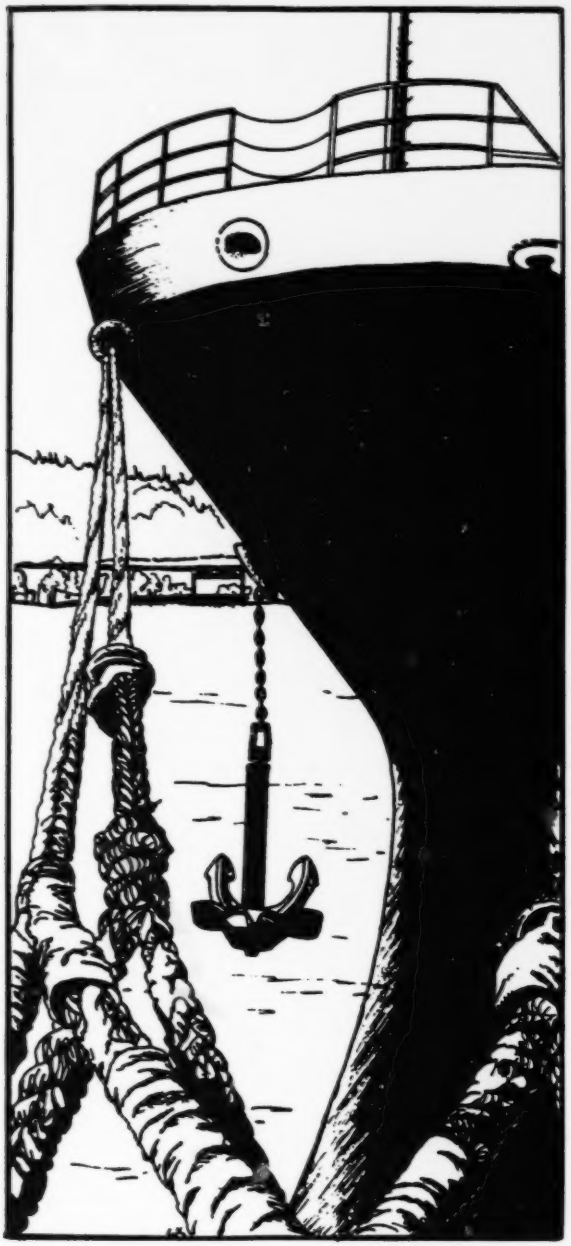
2. Make a filtration tube: wrap the window screen around the bottom of the tube; secure it with a rubber band. Pour in charcoal, then a layer of fine gravel, then a layer of sand, then a layer of coarse gravel. Mix some dirt into the glass of water (the water should look dirty with particles of "dirt" floating in the glass).

3. Pour some of the contents through your filtration tube; make sure you pour slowly and have the container at the bottom end of the tube to collect the water. This may take several minutes. Discuss what is happening while the water is going through the tube.

4. What is happening to the water? What happens to the "dirt" in the water? Discuss how this process happens in nature (how water percolates through the soil).

Extended activities:

Ask students to find out where the school gets its drinking water. Is it supplied by a well? By the city? Have interested students contact the local water department to see if the local water needs to be "treated" before it is used. Have the students report their findings to the class.



Navigation

Transportation and Navigation: A Reading

Close your eyes. Picture the Columbia River many years ago. What kind of boats do you see on the river?

For hundreds of years, Indians traveled by canoe on the Columbia River. Thousands of Indians brought goods to trade at the Long Narrows and Wy-Am. Many different Indian cultures traded, fished, and played there.

Early white explorers such as Lewis and Clark used the river, too.

Fur companies established trading posts on the Columbia. In 1811, the Columbia's first port was founded at Astoria by the Astor Company. By the 1830s the Hudson's Bay Company had a trading empire on the Columbia.

Early settlers traveled down the Columbia after a hard 2,000 mile journey along the Oregon Trail. River towns were built. Portland became the chief port because it was as far up the river as oceangoing schooners could go.

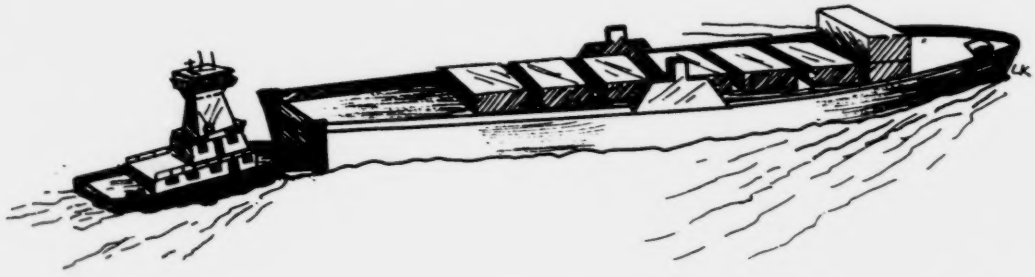
Steamboat travel began on the Columbia in 1850. By the 1860s steamboats served the Columbia and Snake from Astoria to Lewiston. Steamboat travel was sometimes made dangerous by low water,

Sternwheeler

rapids, or ice. At some spots in the river, such as the Great Cascades and Celilo Falls, even powerful sternwheelers could not move through the waterfalls and rapids. Portages, or places where boats or goods were carried overland, were needed to get around the trouble spots.

The Corps of Engineers made its first navigational survey of the Columbia in 1867. It removed rocks, rapids, and snags, made a channel from Portland to the ocean, and built canals to make river travel easier.

When railroads and trucks began to be used to move goods and people, traffic on the river dropped. Then the Corps of Engineers built the North and South Jetties at the mouth of the Columbia. These jetties made it easier for ships to enter and leave the river, and trade on the lower Columbia increased.



Tug and Barge

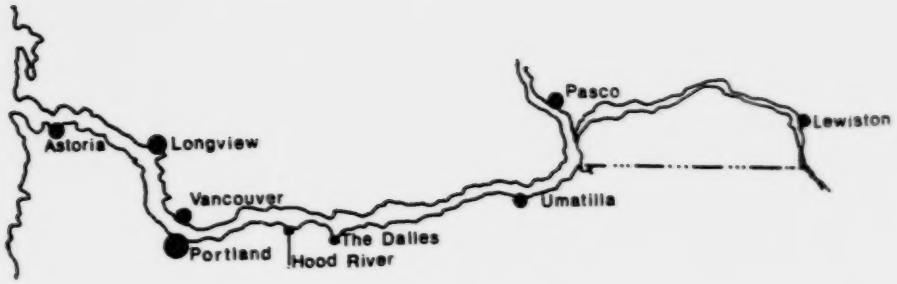
In the 1930s modern barge traffic began on the river. The Bonneville Dam and lock made river travel easier for such vessels. Seven more dams were built. They make it possible for barges to travel all the way to Lewiston, Idaho.

What do these vessels carry? Where do these vessels take their cargoes?

Look at a world map. Find the mouth of the Columbia River at Astoria, Oregon. Follow a route north along the coast of Canada and the coast of Alaska and west across the Aleutian Islands. Turn west and south to Japan, Lorea, Taiwan, China, The Philippines, Indonesia, and Australia. You have just traced the "Pacific Rim." This is where many of the products from the Columbia River system are sent, or exported.

Many different products are exported, as you will see in a later activity. Grain is one export. Grain is loaded on barges in many upriver ports, such as those at Lewiston, Umatilla, and Pasco. At downriver ports, such as those at Portland, Vancouver, Kalama, or Longview, it is moved to ocean-going ships. It is exported to Pacific Rim countries.

MAJOR PORTS



Activity: Fabric Pillows/Vessels of the Columbia

Concepts:
1. Navigation is a traditional use of the river system.
2. Steamboat travel was most important from the 1850s through the 1880s.
3. About 100 million tons of cargo go up and down the Columbia each year.

Objectives. The students will be able to
1. describe vessels found on the Columbia River in the past.
2. describe vessels found on the Columbia River today.
3. find Pacific Rim nations on a world map.

Teacher prep:
1. Gather necessary materials.
2. Make student copies of the reading selection.

Materials:
1. student reading selection
2. muslin fabric (12" x 12" square for each student)
3. fine-tipped permanent markers
4. fabric of any bright color or pattern (12" x 12" square for each student)
5. stuffing
6. sewing machine or needles and thread
7. world map

Procedure:

1. Distribute the student reading selection. Have students read aloud. Point out the Pacific Rim countries during the reading. Trace the movement of grain exports on the world map. Discuss the changes in vessels used on the river. Discuss power sources for the vessels. What kind of fuel was and is used by each vessel? Where was and is that fuel obtained? Ask student volunteers to draw these vessels on the board: canoe, steamboat, tugboat and barges, deep-draft ship.

2. Distribute muslin squares and felt markers. Ask students to draw a vessel used on the Columbia in the past or used today on their square. Remind students to make large, colorful drawings which do not go closer than one inch to each edge. Have students label their vessel and sign and date their drawing. Have students sew their muslin square to another fabric square, putting right sides together and leaving part of one side unsewn. After they have finished sewing, have students turn the fabric right side out, put stuffing inside, and carefully sew the squares shut. The result will be a colorful Columbia River vessel pillow.

Extended activities:

1. Have students make a classroom display of drawings matching Columbia River vessels to their typical cargo.

2. Have students investigate naval architecture. What is a naval architect? What schooling does a naval architect need? Where can you learn to be a naval architect?

3. Have students find the book Pacific Tugboats by Gordon Newell in the library. They might want to memorize and recite "His Majesty the Tug Boat" for the class.

Activity: The Navigation Lock

Concepts:
1. A lock is needed for vessels to pass a dam.
2. A lock uses 43 million gallons of water.
3. A lock works through a system of gates and valves.

Objectives: The students will be able to
1. define "navigation."
2. show how a lock works.
3. state the benefits and the drawbacks of a lock.

Teacher prep:
1. Make an overhead transparency of the side view of the river, showing the location of the locks.
2. Make student copies of the reading selection.
3. Make felt pieces, as shown in the diagram.
4. Gather necessary materials.

Materials:
1. student reading selection
2. side view transparency
3. felt squares
4. flannel board or a large piece of flannel tacked to a bulletin board
5. map of the Columbia

Procedures:

1. Distribute reading selection. Have students read orally. Have students show the route from Lewiston to Portland on the map. Discuss the use of locks. Ask students: What is navigation? What is a vessel? What types of vessels would use a lock on the Columbia? What might be transported in a vessel on the Columbia? What dangers could you face going through a lock? Discuss the conflict in uses of Columbia River water involved in a lockage.

2. Show students the flannel board lock. Ask volunteers to be a tugboat captain and to put their tug and barges through the lock. Be sure to have students show both upstream and downstream lockages.

Extended activities:

1. Ask students to design a model of a lock using milk cartons. Have students work in the class sink. Give students an opportunity to share their models with the class.

2. Have interested students write to the Corps of Engineers for further information on locks. Addresses:

Public Affairs Office
North Pacific Division
P.O. Box 2870
Portland, OR 97208

Public Affairs Office
Portland District
P.O. Box 2946
Portland, OR 97208

Public Affairs Office
Seattle District
P.O. Box C-3755
Seattle, WA 98134

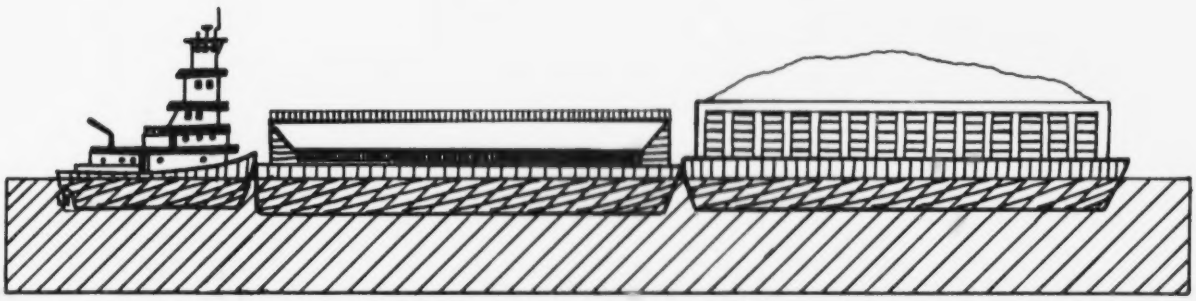
Publica Affairs Office
Walla Walla District
City - County Airport, Bldg. 602
Walla Walla, WA 99362

3. Have students investigate how locks are built.

4. Have students investigate who operates the lock and how that person is trained.

The Navigation Lock: A Reading

You have been hired as a tugboat captain. Your job is to move barges loaded with grain from Lewiston, Idaho, to Portland, Oregon. How are you going to get past the dams in the river? How are you going to drop from one level of the river to another? (Look at the side view of the river. You can see the many levels through which you must pass.)



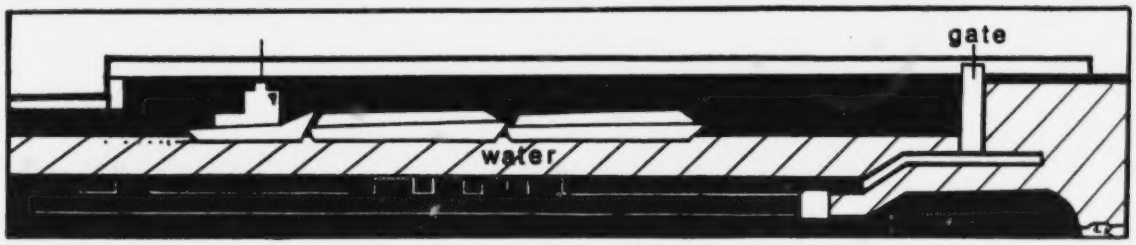
Columbia River Tug and Barge

In the Columbia River system, the level of the water behind a dam may be up to 100 feet higher than that of the water below. A navigation lock permits vessels to pass from one level to the other.

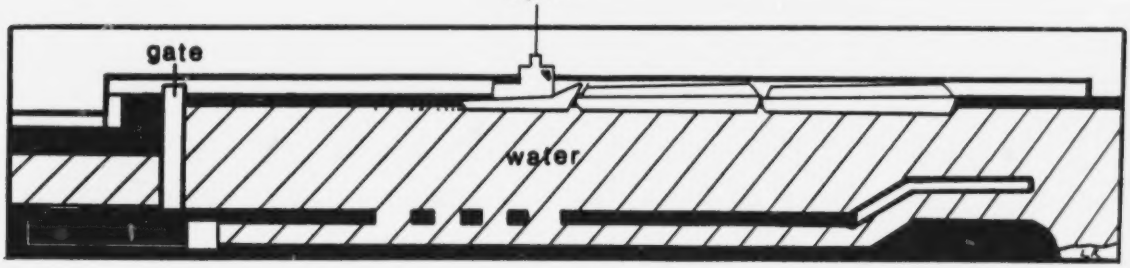
Look at the diagram of the lock. As the tugboat captain, you would put your tug and barges through a downstream lockage. You would enter the lock when the downstream gate was closed. The upstream gate would be closed behind you. Water would be emptied out of the lock through a system of valves. The downstream gate would open. Your vessel would leave the lock. This would take about 20 minutes.

THE LOCK

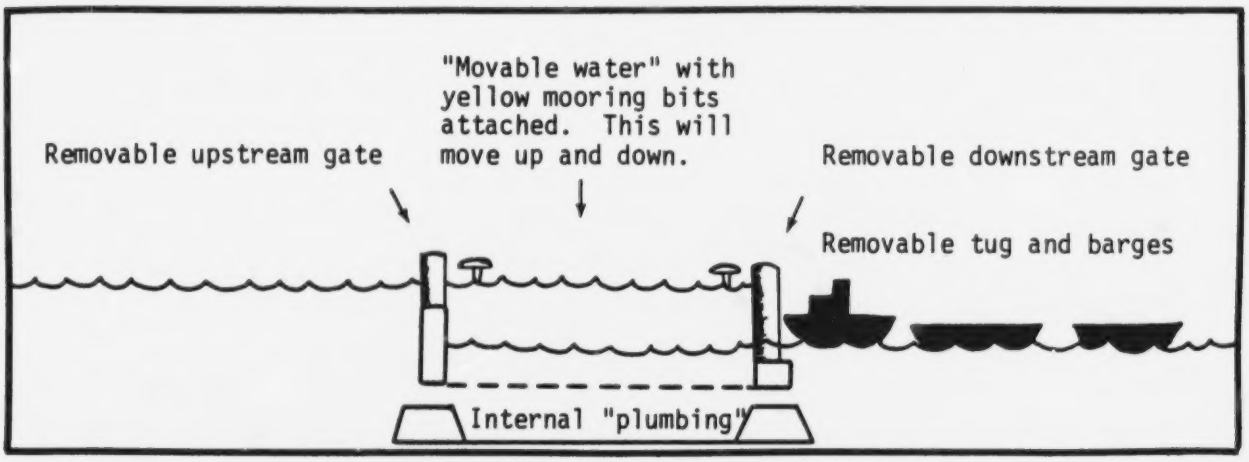
Closed



Open



If you were going in the other direction, things would happen in reverse. In an upstream lockage, the upstream gate closes. Water empties out of the lock through a system of valves. The downstream gate opens and the vessel enters the lock. The downstream gate closes and the lock fills up again with water. The upstream gate is opened and the vessel leaves the lock.


"Movable water" with yellow mooring bits attached. This will move up and down.
Removable upstream gate
Removable downstream gate
Removable tug and barges
Internal "plumbing"

Another View of a Lock

The eight Columbia River locks are open to all vessels, whether they are used for business, like tugboats and barges, or for fun, like sailboats and powerboats. Every time a lock is used, about 43 million gallons of water are used (except at the small Bonneville lock). Forty-three million gallons of water could produce enough energy to supply the electricity used in one Northwest home for half a year.

Activity: World Maps/Exports and Imports

Concepts:
1. Commerce on the Columbia River is an important part of the economy of the Pacific Northwest.
2. Exports and imports involve many foreign nations, especially Pacific Rim countries.
3. About 10 million tons of cargo move up and down the river each year.

Objectives: The students will be able to
1. define "export."
2. define "import."
3. name several countries involved in Columbia River trade.
4. find on a world map foreign nations involved in commerce.

Teacher prep:
1. Make student copies of the world map (two for each student).
2. Make student copies of the "Leading foreign commerce nations" chart.
3. Gather necessary materials.

Materials:
1. world map (two copies per student)
2. foreign commerce nations chart for each student
3. colored pencils or fine-tipped markers

Procedures:

1. Distribute one world map and the commerce charts to each student. Ask students: What is an export? What is one product we export from the Columbia River area? Where do you think that product might be sent? What is an import? What is one product we import to the Columbia River area? Where does that product come from? Have students read the list of leading export nations and their matching tonnage. Ask students to define a "short ton." Have students find on the world map each country listed under exports. Ask students to color export nations green on their maps. Have them label their map and make a map legend.

2. When students have completed their export map, distribute the second set of world maps. Have students color import nations red. Have students label these maps and make a map legend.

3. Ask students to compare the two maps. What nations are both leading export and import nations? Why might we do so much business with these countries?

Extended activities:

1. Ask students to choose one of the leading foreign commerce nations for further study. Have students prepare a report for the class on the chosen nation.

2. Have students make a bulletin board on foreign trade and the Columbia River. It could include magazine pictures of the leading foreign commerce nations, maps, graphs of exports and imports, samples of goods traded, and so on.

Leading Foreign Commerce Nations

Exports	(Short tons)	Imports	(Short tons)
Japan	3,485,277	Japan	536,224
Republic of Korea	1,478,030	Australia	419,731
Egypt	1,058,867	Canada	244,423
Republic of China (Taiwan)	636,829	People's Republic of China	88,427
India	608,829	West Germany	62,321
Philippines	560,040	Philippines	37,164
Indonesia	410,616	Malaya	34,864
Malaya	258,286	Venezuela	26,724
Belgium	163,421	Belgium	22,064
People's Republic of China	131,302	United Kingdom	13,705

Activity: Graphing Commodities

Concepts:
1. Commerce on the Columbia River is an important part of the economy of the Pacific Northwest.
2. Foreign exports are handled at several ports besides Portland, Oregon.
3. A variety of commodities are exported from Columbia River ports.

Objectives: The students will be able to
1. define "commodities."
2. graph the leading exported commodities handled by Columbia River ports other than Portland, Oregon.
3. name four Columbia River ports.

Teacher prep:
1. Make student copies of the commodities chart or make an overhead transparency.
2. Gather necessary materials.

Materials:
1. student copies or transparency of commodities chart
2. graph paper
3. colored pencils

Procedures:

1. Distribute the commodities charts. Ask students to read the title of the chart. Ask students: What is an export? What is a port? What ports besides Portland are found on the Columbia? What are commodities? Have students read the list of commodities and their matching tonnage. Be sure students know what each commodity looks like and how it is used.

2. Distribute the graph paper and colored pencils. Review how a bar graph is made. Ask students to make a graph showing the 13 leading exported commodities. Remind students to label their graphs.

3. Display the graphs in the classrooms.

Extended activities:

1. Have students bring in samples of the 13 commodities. Make a display of the samples. Use magazine pictures if samples are not available.

2. Have students investigate the uses of each commodity. Have students present their findings to the class.

Principal Foreign Exports Handled by
Columbia River Ports Other Than Portland**

Thirteen Leading Commodities	(Short tons)
Wheat	4,282,656
Logs	3,596,901
Woodchips	271,069
Lumber	230,548
Barley	207,271
Paper and newsprint	177,749
Corn	176,818
Paperboard	104,433
Beet pulp pellets	97,247
Milo	87,575
Aluminum	63,734
Wood pulp	50,021
Soda ash	38,971

**Astoria, Oregon, plus Kalama, Longview, and Vancouver, Washington

Activity: Reading a Chart

Concepts: A great variety of commodities are imported and exported through Columbia River ports.

Objectives: The students will be able to
1. list several commodities imported through Columbia River ports.
2. list several commodities exported through Columbia River ports.
3. read a chart of exports and imports to find specific data.

Teacher prep:
1. Make student copies of the foreign commerce chart and the question sheet.
2. Make an overhead transparency of the chart.

Materials:
1. foreign commerce chart
2. student question sheet

Procedures:

1. Distribute the foreign commerce chart. Ask students, as a review: What is a commodity? What is an export? What is an import? Show students how to find specific data on the chart. Go through examples of finding data with the class until they understand how to read the chart.

2. Distribute the student question sheet. Ask students to answer the questions by using the foreign commerce chart.

3. When students have finished the question sheet, have them exchange and correct their papers. While correcting the papers, point out the great variety of commodities exported and imported.

Extended activities:

Have students make a display showing one commodity exported or imported, the type of vessel which carries it on the Columbia River, and a finished product showing how that commodity is used.

Reading a Chart: Foreign Commerce

Name _____ Date _____

1. How many tons of canned and frozen salmon are exported?
2. Is marble exported or imported?
3. How much basketware is imported?
4. How many tons of hides are exported?
5. How many tons of hides are imported?
6. How many tons of toys are imported?
7. How many boxes of pears are exported?
8. Are lentils imported or exported?
9. Is coal imported?
10. Is coal exported?
11. Are more petroleum products exported or imported?
12. Are more autos imported or exported?
13. How many tons of baled hay are exported?
14. How much old newspaper and waste are exported?
15. How many tons of chilled and frozen beef are exported?
16. How much coffee is imported?
17. In what year were these amounts of imports and exports recorded?
18. Was more cement imported in 1981 or in 1982?
19. Which commodity was imported in the greatest amount?
20. Which commodity was exported in the greatest amount?

TOTAL OCEAN COMMERCE

	1981 (Short Tons)	1982 (Short Tons)
Inbound From Foreign Ports	2,156,863	1,780,605
Outbound To Foreign Ports	10,677,202	9,537,471
Totals		
Dry Cargo	12,699,702	11,248,255
Petroleum[1]	2,744,986	2,046,974
Foreign In and Out	12,834,065	11,318,076

REGISTRY OF ARRIVING VESSELS*

Flag	1981	1982
Japanese	426	442
Liberian	390	357
American	305	288
Panamanian	199	262
Republic of Korea	139	130
Greek	104	91
Norwegian	76	62
British	46	43
Indian	32	39
Danish	39	31
Swedish	29	27
Canadian	45	22
Philippine	10	21
Republic of China (Taiwan)	31	17
Dutch	16	16
Singaporean	15	16
Argentinean	6	11
Bulgarian	0	11
Russian	27	11
People's Republic of China	13	7
French	3	5
German	9	5
Indonesian	8	5
Malaysian	3	5
Australian	0	4
Irish	2	4
Belgian	0	3
Cyprian	7	3
Bahamian	0	2
Yugoslavian	3	2
Brazilian	0	1
Chilean	3	1
Colombian	0	1
Ecuadorian	0	1
Finnish	4	1
Italian	3	1
Mexican	0	1
Netherland Antilles	3	1
Nicaraguan	0	1

**Columbia River arrivals. Does not include military vessels, oceangoing tugs or American barges.*

LEADING FOREIGN COMMERCE NATIONS

Exports (Short Tons)		Imports (Short Tons)	
Japan	3,485,277	Japan	536,224
Republic of Korea	1,478,030	Australia	419,731
Egypt	1,058,867	Canada	244,423
Republic of China (Taiwan)	636,829	People's Republic of China	88,427
India	608,829	West Germany	62,321
Philippines	560,040	Philippines	37,164
Indonesia	410,616	Malaya	34,864
Malaya	258,288	Venezuela	26,724
Belgium	163,421	Belgium	22,064
People's Republic of China	131,302	United Kingdom	13,705

VALUE OF EXPORTS AND IMPORTS

(Ten Leading Nations)

Oregon Customs District[2]

(All Oregon ports plus Washington ports along the Columbia River for all modes of transportation.)

Exports	
Japan	$1,531,742,283
Republic of Korea	330,539,714
Egypt	234,867,025
Republic of China (Taiwan)	163,212,010
Philippines	159,310,043
India	119,843,166
Indonesia	108,879,227
People's Republic of China	86,767,457
Australia	79,314,630
Italy	45,538,638
1982 Total Export Value	**$3,316,017,452**

Imports	
Japan	$1,562,522,367
Australia	235,598,545
Republic of Korea	154,294,445
West Germany	152,197,651
Republic of China (Taiwan)	100,411,485
Sweden	50,715,383
People's Republic of China	42,333,455
Malaysia	36,891,445
United Kingdom	32,336,461
Canada	30,626,416
1982 Total Import Value	**$2,631,661,413**

PRINCIPAL FOREIGN EXPORTS HANDLED BY COLUMBIA RIVER PORTS OTHER THAN PORTLAND (1&2 BELOW)

(Astoria, Oregon, plus Kalama, Longview and Vancouver, Washington)

(1) Thirteen Leading Commodities	Short Tons
Wheat	4,282,656
Logs	3,596,901
Wood chips	271,069
Lumber	230,548
Barley	207,271
Paper and newsprint	177,749
Corn	176,818
Paperboard	104,433
Beet pulp pellets	97,247
Milo	87,575
Aluminum	63,734
Wood pulp	50,021
Soda ash	38,971

(2) Thirteen Leading Foreign Commerce Nations	Short Tons
Japan	4,701,720
Republic of Korea	934,277
Egypt	669,974
Philippines	505,596
Republic of China (Taiwan)	436,288
People's Republic of China	434,058
Indonesia	286,521
India	212,519
Malaya	118,017
Chile	84,573
Australia	80,139
Hong Kong	55,531
Bangladesh	39,414

Sources:

Except where noted, all data derived from Merchants Exchange of Portland, Oregon, "Foreign Import and Export Statistics for Portland, Oregon, Via Water," 1982 Annual Report. Includes data from Port of Portland public facilities and private operat ons.

[1]Portland area petroleum movement statistics.

[2]First Interstate Bank of Oregon, N.A., International Division.

Commodity	Exports (Short Tons)	Imports (Short Tons)
Aluminum	7,538	
Aluminum mfgs.	20	
Apples, fresh (14,776 bxs.)	369	
Autos	37	
Autos, vans and parts	819*	293,889
Bambooware		51*
Barley (27,134,522 bu.)	651,229	
Basketware		104
Beans, dried	4,456	
Beef, chilled and frozen	4,996*	
Bentonite clay	219,033	
Beverages, alcoholic	1,744	5,293
Buckwheat	851*	
Building materials		1,099
Building supplies	11,970	
Buildings, precut/prefab	218	
Bulbs and garden seed	1,342*	
Bullets and explosives	98	
Burlap and bags		4,639*
Carbide, silicon	460	
Carbon products		713
Cascara bark	15	
Cement		30*
Chemicals	1,955*	24,973
Cherries, chilled	944	
Coal	14	4,598*
Coconut, dessicated		185*
Coconut oil		38,262*
Coffee		867*
Coke	37,116*	
Corn, canned	9,123	
Corn, frozen	9,592	
Cotton	369*	
Dry goods and clothing		3,048
Earthenware and porcelain		433
Electric mfgs.		5,034*
Electrical goods	18	
Electrode pitch		40,457*
Fertilizers	20	
Fish, canned and frozen		283*
Fish, NOS** and extract	1,794*	
Fish meal		26
Flour (144,921 cwt.)	7,246	
Foodstuffs, NOS**	4,511	9,727
Footwear		6,192
Fruits, canned	4,390*	
Fruits, frozen	1,605	
Furniture		1,232*
Glass products		307
Glass, window and plate		551*
Hardware and tools		1,316
Hay, alfalfa cubes	10,641*	
Hay, baled	1,924*	
Hides	35,832*	
Hops and extracts	58	
Infusorial earth	122	
Iron and steel, NOS**	54	
Iron and steel casting	31	
Lab and technical equipment	1,393*	
Lentils	2,643*	
Lignin pitch	38	
Livestock	264	
Logs (85,019,082 ft.)	195,544*	
Logs and lumber		369
Lumber (81,639,815 ft.)	134,706	
Machinery and parts, agric.	604	
Machinery and parts, lift trucks	900	
Machinery and parts, lumber	1,176	
Machinery and parts, mining	1,152	
Machinery and parts, NOS**	3,117	18,030
Malt	5,511*	
Marble, granite and stone		185
Meat, NOS**	103	
Merchandise, NOS**	1,495	
Metal, misc. iron and steel products		261,897
Metal, NOS**	462	
Metal scrap	183,894	
Milk, powdered	2,924*	
Milo (1,168,686 bu.)	32,723	
Mineral talc	22,542*	
Miscellaneous		6,245
Miscellaneous, household goods	162	
Molasses		5,131*
Molds, pottery	3	
Motorcycles, parts and accessories		131
Nickel ingots	97*	
Nursery supplies	33	
Nuts	838	
Oats	111*	
Oats, rolled	89*	
Oil, s'mint, p'mint and essence	187	
Oil, tall	1*	
Old newspaper and waste	14,136*	
Onions	1,057	
Oranges, canned		2,024
Ore:	60	
Alumina		416,211*
Bauxite		18,740*
Ferromanganese		551
Limestone rock		197,219
Manganese		20
Ore, NOS**		33
Paints and resins	248	
Palm oil		37,748
Palmyra stalks		7*
Paper and mfgs.		19,709*
Paper and newsprint	3,923*	
Paper products	10,353	
Paperboard	114,282	
Pears, fresh (4,909 bxs.)	123	
Peas, dried	25,164	
Petroleum products	22,900*	114,149*
Pineapple, canned		2,729
Pipes, NOS**		27,012
Plywood	28,157	
Plywood and veneer		65
Pork, frozen	275	
Potatoes, dehydrated	22,152*	
Potatoes, frozen	19,401*	
Poultry, frozen	66	
Poultry and stock feed	2,530*	
Prunes, dried	325	
Quartzite rock	49	
Recreational equipment		422
Rope and twine		465*
Rubber, crude		24
Rugs, carpets and mats		57
Salmon, canned and frozen	3,851*	
Salt, crude		183,828
Seed, bentgrass	891	
Seed, clover	381	
Seed, NOS**	9,713*	302
Seed, ryegrass	4,473	
Seed grass, NOS**	5,700*	
Shellfish, canned and frozen	197	
Soap and powder	9*	
Soda ash	53,455*	
Soybeans (228,223 bu.)	6,162*	
Tallow	3,854	
Tires and tubes		7,703
Toys		90
Trucks	386	
Tuna, canned		504
Vegetables, canned	405*	
Vegetables, fresh	15*	
Vegetables, frozen	4,581	
Wheat (227,432,348 bu.)	6,822,970	
Whey powder	566*	
Wire		14,773*
Wood burls and logs	803	
Wood chips	720,691*	
Wood mfgs.	726*	42*
Wood pellets	311*	
Wood poles	2,011	
Wood pulp	4,654	19*
Wood putty	59	
Wool		432*
Yarn, NOS**		430*
Zinc	140*	

*Indicates increase over preceding year
**Not otherwise specified

Activity: Ships that use the Columbia

Concepts:
1. Much of the Columbia River trade is with Pacific Rim countries.
2. Farm and forest products are the main export items from the Columbia, while manufactured goods and raw materials are the major import items.
3. Ships of different types are used to carry the different items.

Objectives: The students will be able to
1. identify different exports and imports passing in and out of the Columbia River.
2. identify some of the countries trading with ports on the Columbia River.
3. identify different types of ships using the river.

Teacher prep:
1. Gather appropriate materials for activities.

Materials:
1. toy cars
2. salt
3. small items of iron or steel
4. lumber twigs to represent logs
5. wheat
6. barley

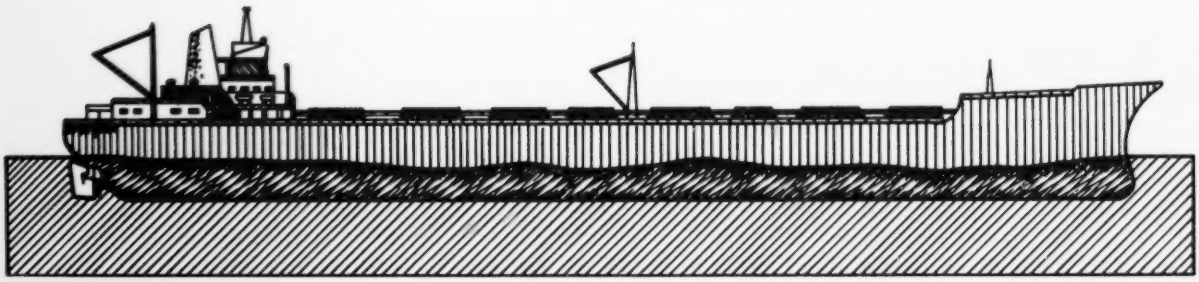
Procedures:

1. Collect items that are exported and imported into the Columbia. Separate into an export group and an import group. For example, the import group could comprise toy cars, salt to represent crude salt, and small items of iron or steel. Wheat, small pieces of lumber, and twigs to represent logs could represent the export group.

2. From the drawings and descriptions of ships included in this section, identify the types of ships that would carry the represented goods, i.e., a dry bulk carrier for wheat, car ships for cars, and so on. Discuss why different ships have different designs.

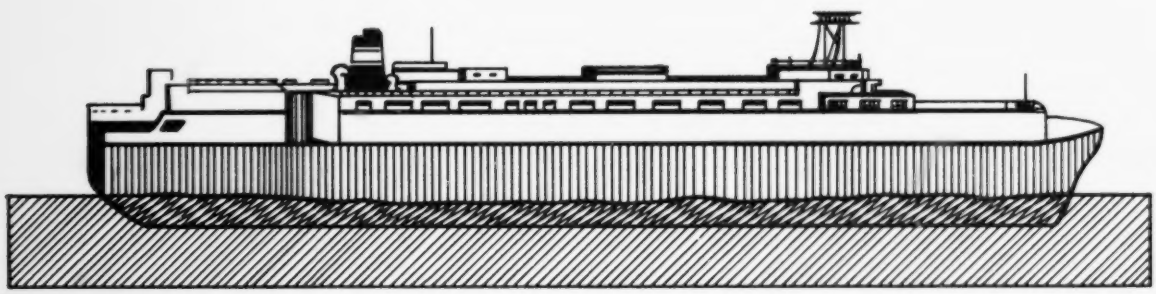
3. Check the ship's log in the Oregonian to record the types of ships scheduled to visit the Port of Portland. Record the countries they are from and the type of goods they might be carrying.

4. Have students conduct a scavenger hunt in their homes for goods that might have been imported into the U.S. List the items in class.



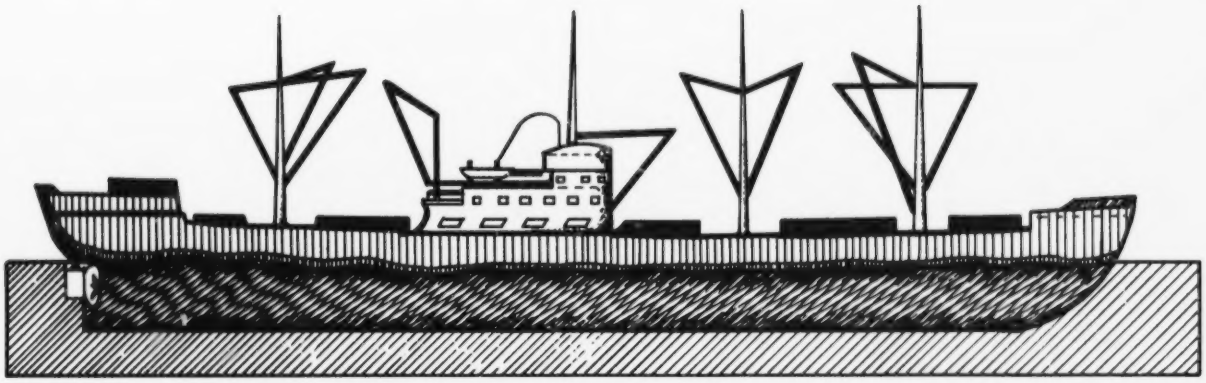
DRY BULK CARRIER

Large compartments in the holds of these ships are filled with grain, sugar, ores, fertilizers, or other dry materials. These ships are often seen at dock with long, round hoses that drop down into the holds to fill up the compartments.



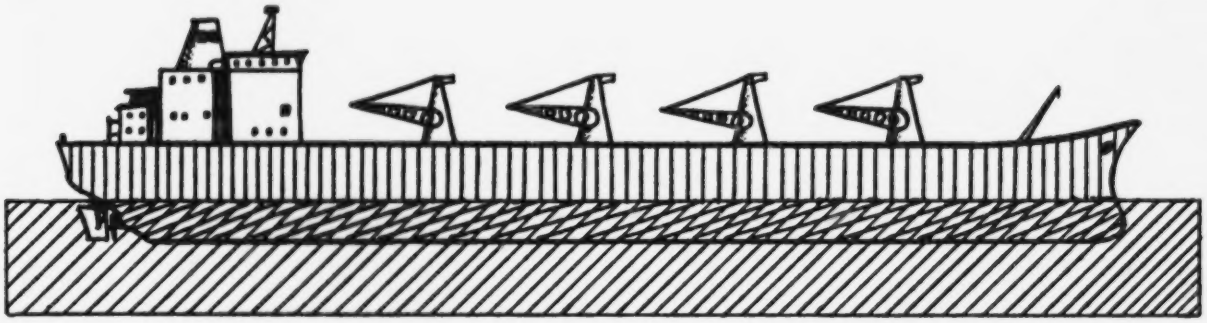
CAR SHIP

These ships are designed specifically to transport one item, cars. Cars can be driven on and off these ships by ramps which lower from the ship on to the dock. These ships usually carry no other item, and so they are loaded on only one half of their trip. They load cars in Japan, unload in the U.S., and return empty for another load of cars.



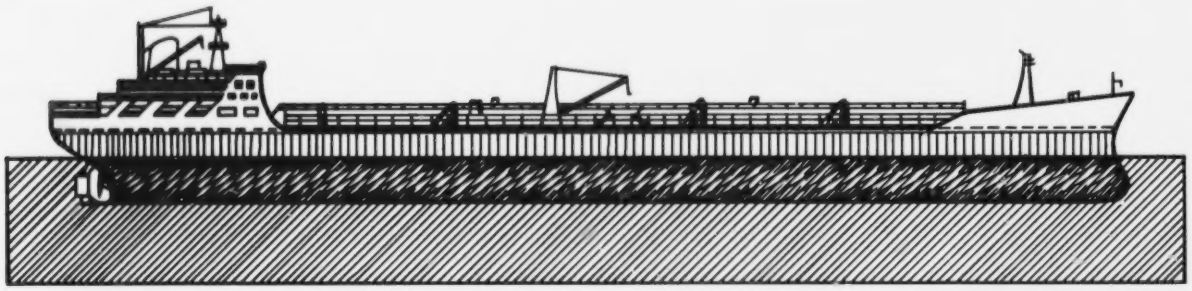
CARGO SHIPS

Unlike the large container ships, cargo ships or freighters can carry containers of all sizes. The type of goods they carry varies greatly, from tractors, to canned foods, to cartons of apples, and so on. These ships have large derricks on board which are used to unload their cargo.



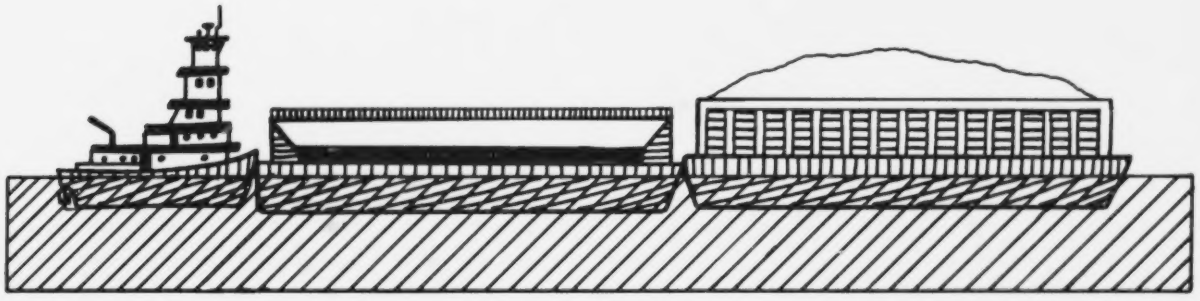
CONTAINER SHIPS

Container ships carry large containers all of one size. Large dockside cranes lift the containers on and off the ships. The containers are then moved by truck or train to their final destination. Containers can be filled with any number of items, from stereos and cameras to lumber. Some of the containers are refrigerated and can be used to transport food.



TANKERS

Tankers transport liquid materials. The most common materials transported by tankers is oil. Small tankers can enter ports, but super tankers must be anchored at sea and offloaded near shore. In addition to oil, other liquids such as vegetable oil, molasses or tallow can be carried.



COLUMBIA RIVER TUG AND BARGE

These tugs and barges are designed for use on the river only. They are a common sight moving goods up and down the river system. The bottom part of some of the barges is designed to carry fuel while the upper part carries grain. With this design, they can transport grain from inland farm areas to Portland for export and pick up fuel to be carried upriver to ports in Washington, Oregon, and Idaho.

CHARTER BOATS

Most ports and harbors in Oregon offer recreational boating facilities. One of the pleasure boats often seen in harbors are the charter boats. These can carry from 6 to 30 passengers and are used for ocean fishing, whale watching, or even pleasure excursions.

COMMERCIAL FISHING VESSELS

Commercial fishing vessels dock in Oregon harbors. The type of equipment these boats carry is geared for the type of animals they are fishing. For example, if they fish for bottomfish, they are equipped with large nets. Salmon boats have troll poles and lines, and crab boats are equipped with crab pots and winches for pulling the pots on board.

Graph 1

Principal Items Exported by Columbia River Ports

Item	Short Ton
Wheat	4,282,656
Logs	3,596,901
Woodchips	271,009
Lumber	230,548
Barley	207,271

Principal Items Imported Into Columbia River Ports

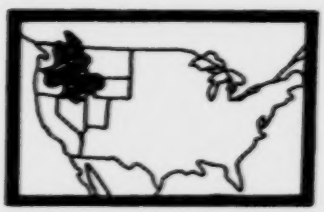
Item	Short Ton
Aluminum ore	416,211
Autos, vans, and parts	293,889
Metal iron and steel products	261,897
Crude salt	183,828
Petroleum products	114,149

Summary

Summary: A Reading

In our study we have learned that the Columbia River is very important in our daily lives. We could say that it is the life blood of the Pacific Northwest. Because of its many applications, we are constantly using this resource--in the energy we consume, in the food we eat, in the products we may buy.

We have discovered that some of these uses compete with one another for the water of the Columbia. We now may have to make trade-offs in the way these waters are used, since there may not be enough water to meet all our needs. Because of the size of the river system and the number of people involved in managing it, making these trade-off decisions is not easy.



The Columbia Basin includes parts of seven states plus the Canadian province of British Columbia. Some tributaries of the system cross the international border three times before entering the Pacific Ocean. Management authority for power generation, flood control, commerce, and other use is fragmented among local, state, regional, federal, and international agencies. Dozens of specific interest groups as well as local, regional, and national committees are also involved in some aspect of the Columbia Basin policy. Because of the complexity and variety of the institutions and interests involved, over time a piecemeal, fragmented approach has evolved toward the problems and management of the waters of the Columbia River basin.

It is urgent that something be done. The Columbia River is no longer resilient and inexhaustible. It has clearly begun to show its vulnerability to overuse and to inadequate, uncoordinated, and inconsistent management. The river has been extensively developed for some uses without regard to the effects of these uses on other activities, on people, and on the environment.

Over the next few years, the citizens of the Pacific Northwest will be faced with vital regional choices about how, where, and under what conditions our water resources should be used. It will be a difficult time of decision and will involve a question of balance. In this decision-making process, we all have a role to play. By becoming aware of the issues and conflicts, and by understanding them, we will have an opportunity to voice our concerns so that rational decisions regarding the Columbia River will be made. By getting involved ourselves, we can help to ensure that the waters of the Columbia system are allocated in the future to allow a compatible mix of resource uses for the benefit and enjoyment of all. The choice is up to us.

Activity: Word Find

Concepts:
1. The Columbia River has many uses.
2. The Columbia River is important in the Pacific Northwest.
3. The Columbia River system must be carefully managed.

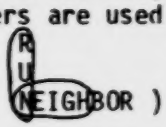
Objectives: The students will be able to
1. categorize given words related to the Columbia River.
2. locate words related to the Columbia River system which are hidden in a puzzle.
3. tell why the Columbia River system must be managed carefully.

Teacher prep: Duplicate student copies of the word list and the word-find puzzle.

Materials: class set of word list and word find puzzle

Procedures:

1. Distribute copies of the word list to students. Have volunteers read the list orally. Ask students to look for ways to organize the word list into categories about the Columbia. List suggested categories on the board. Have students group the words according to the suggested categories. Encourage various groupings.

2. Distribute the word-find puzzles. Ask students to search for words from the word list hidden in the puzzle. Explain that words are horizontal, vertical, diagonal, forward, and backward. Some letters are used in more than one word. (example: 

)

   A message can be formed by putting all the unused letters together when the puzzle is completed.

3. When students are finished, have a volunteer share the hidden message. (The puzzle takes time. It is a good project to begin together and have students finish in their free time or as homework.)

4. Ask students to write a paragraph explaining the message. Why should the river be managed carefully? Give students an opportunity to share their paragraphs with the class. During this discussion, stress that the students may be faced with making river management decisions in the future.

Extended activities:

Have students design their own word-find puzzles, complete with word list, about one aspect of the Columbia River. Duplicate the puzzles so that students can exchange puzzles and try to solve those designed by other students.

Word List

CLARK
PEARS
LEWISTON
GORGE
BONNEVILLE
MANAGEMENT
COLUMBIA
THE DALLES
LOCK
DAM
CORN
HYDROPOWER
NAVIGATION
IRRIGTION
ENERGY
BRIDGE OF THE GODS
AGRICULTURE
TRANSPORTATION
INDIAN
ANADROMOUS
STEELHEAD
COYOTE
TROLLING
HOOK-AND-LINE
SHAD
RIVER
RECREATION
SALMON
TUG
PEAS
MONTANA
IDAHO
DOUGLAS
ASSIMILATION
GRAY
GAS
RUTS

WASHINGTON
CELILO FALLS
SEA
OREGON
SPAWNING
TRIBUTARIES
COHO
CANADA
HATCHERY
HABITAT
USA
SNAKE
BASIN
GRAND COULEE
BASIN
FISH WHEELS
FLOW
RAFT
BARGES
EXPLORER
LEGENDS
PRODUCTS
ROE
RAIN
WIND
USES
MIST
STEAMBOAT
LENTIL
WHEAT
LEWIS
COAT
BEAVER
ANT
NEW
HUT
POW

A Message for the Future

R O C O R N O T G N I H S A W L O U R
E R L O * B H Y D R O P O W E R C O L
C E E U G O R G E M Y A R G I D A H O
R G W V B N I A R U S A E W O L F G I
E O I T A N S N A I D N I M A D R S A
A N S U * E T S I M D A R I V A S T C
T O E G R V B * N S S D Y S N E D E A
I T A G R I C U L T U R E D L H O A N
O S K C O L E E E L U O C T E L G M A
N I M R E L L D A H S M M * N E E B D
N W A E M E I U S T C O Y O T E H O A
O E N R F A L L S * B U E * I T T A N
I L A O P R O D U C T S M A L S F T A
T S G L A S S I M I L A T I O N O F T
A A E P N C L A R K S A L M O N E A N
T L M X A A H A B I T A T G T E G R O
R G E E N I L D N A K O O H D * D D M
O U N V T E S E G R A B E R Y W I N D
P O T G N I N W A P S D * E N E R G Y
S D R C A I R R I G A T I O N R B S B
N F I S H W H E E L S O H O C E F A A
A U V T A E H W L A I B M U L O C E S
R S E S U N O E G R U T S L T O S P I
T S R A E P S L Y N A V I G A T I O N
H A T C H E R Y S E I R A T U B I R T

A Message for the Future

R O C O R N O T G N I H S A W L O U R
E R L O * B H Y D R O P O W E R C O L
C E E U G O R G E M Y A R G I D A H O
R G W V B N I A R U S A E W O L F G I
E O I T A N S N A I D N I M A D R S A
A N S U * E T S I M D A R I V A S T C
T O E G R V B * N S S D Y S N E D E A
I T A G R I C U L T U R E D L H O A N
O S K C O L E E E L U O C T E L G M A
N I M R E L L D A H S M M * N E E B D
N W A E M E I U S T C O Y O T E H O A
O E N R F A L L S * B U E * I T T A N
I L A O P R O D U C T S M A L S F T A
T S G L A S S I M I L A T I O N O F T
A A E P N C L A R K S A L M O N E A N
T L M X A A H A B I T A T G T E G R O
R G E E N I L D N A K O O H D * D D M
O U N V T E S E G R A B E R Y W I N D
P O T G N I N W A P S D * E N E R G Y
S D R C A I R R I G A T I O N R B S B
N F I S H W H E E L S O H O C E F A A
A U V T A E H W L A I B M U L O C E S
R S E S U N O E G R U T S L T O S P I
T S R A E P S L Y N A V I G A T I O N
H A T C H E R Y S E I R A T U B I R T

Message will read: "OUR COLUMBIA IS A RIVER SYSTEM...MUST BE MANAGED CAREFULLY"

Activity: Constructing an Octahedron

Concepts:

1. The Columbia River is a heavily used resource.
2. Uses include power production, transportation, fishing, irrigation, water supply, waste assimilation, and recreation.

Objectives:

The students will be able to

1. list several uses of the Columbia River.
2. illustrate detailed knowledge of the uses of the Columbia.

Teacher prep:

1. Make a class set of octahedron patterns on tagboard or heavy construction paper.
2. Gather necessary materials.

Materials:

1. octahedron patterns with instructions
2. construction paper or tagboard
3. felt markers, crayons, or colored pencils
4. glue
5. scissors

Procedure:

1. Review the many uses of the Columbia River. Ask students to name a way the river is used and to tell what picture comes to mind when they think of that use. List several examples on the board. If necessary, remind students of the water supply and waste assimilation uses.

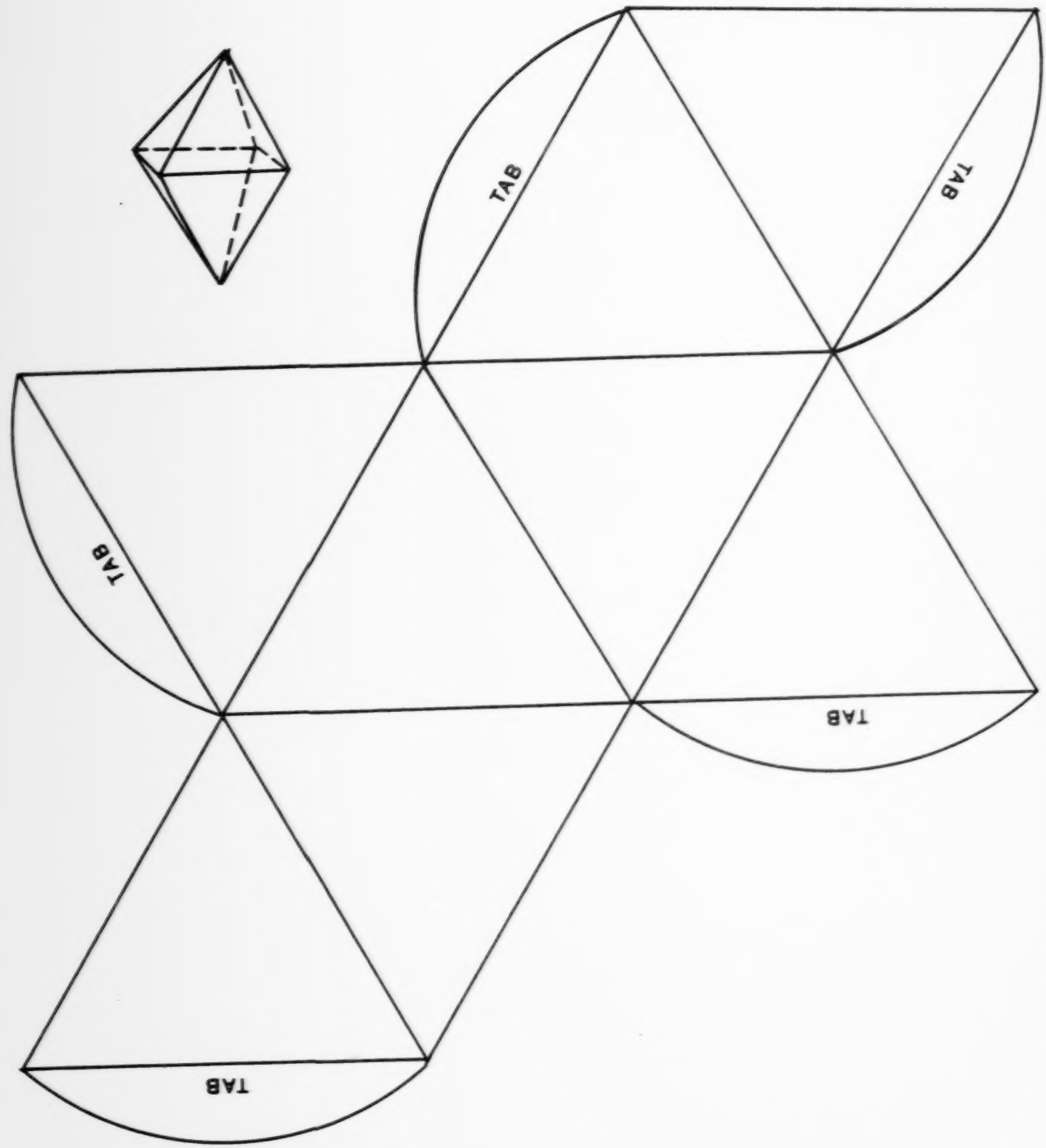
2. Distribute octahedron patterns. Have students draw a detailed illustration of river usage on each face of the octahedron. Instruct students to cut out the shape (after finishing the illustrations) and glue the shape together. You might wish to construct a sample.

3. Give students an opportunity to share their completed octahedrons with the class. During the sharing discussion, stress that the Columbia River is a heavily used resource.

4. Suspend the finished octahedrons by string from the classroom ceiling for display.

Extended activities:

Have students create their own geometric shape patterns and decorate each face of the shape with a detailed illustration of one topic covered in this Columbia River study (ex: an Indian legend cube, an agricultural products tetrahedron).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